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Retiring-president Charles A. Coffin

By far the most important event of the week in electrical circles was the announcement of a change in management of the country's largest and most powerful electrical manufacturing company, which change was foreshadowed in our columns on March 15, 1913. The present commanding position of the General Electric Company must be attributed to the leadership of Retiring-president Charles A. Coffin, of whom it may truly be said that the electrical industry has in every way been the beneficiary of his marvelous constructive ability, his skill as an organizer, his economic efficiency as a manufacturer, his diplomacy as an administrator, his judgment of men, his appreciation of genius, his innate courtesy and adroit suavity in manipulating delicate situations, his untiring capacity for work, and above all his adamant resolve to reach any goal that seemed worth while. With a keen divination of possibilities that has never left him, during those pioneer days in the early eighties when nerve and courage were required to make such a decision, Mr. Coffin, then a young New England shoe manufacturer, determined to throw in his lot with electrical development. He can have no reason now for regretting his decision. Although retiring as president of the General Electric Company Mr. Coffin will maintain his interest in its affairs, and as chairman of the board of directors will continue to give his colleagues the benefit of his unequaled advice and experience. We shall not attempt here to sum up the notable lifework of Mr. Coffin; its significance cannot be disposed of in a few lines. Struggling desperately for supremacy in a field of unparalleled invention and expansion, enlisting and creating wealth that runs into the billions of dollars, Mr. Coffin has been a brilliant and successful exemplar of the old régime, one of its leading exponents. That which not so long ago we all applauded as astute and clever in a man fighting for his own hand the law and public opinion now regard as of questionable propriety or worthy of harsh condemnation. No empire builder of our day has escaped this searching fire of new criticism, so often unfair and unreasoning; but it is part of the spirit of the times, carrying with it the essential justice and equity of changed ideals. Mr. Coffin cannot avoid the consideration of these elements in any review of his extraordinary career, and as in the case of his personal friend Mr. Morgan, it would be vitally interesting to contemporaries to know just how he feels about it himself. Meantime, let it be acknowledged as one more tribute to an exceptional man that from a long period of terrific conflict and upbuilding he emerges well-nigh scatheless as to any personal animosity against him and with the loyal affection and esteem of thousands to whom his energy and genius have given opportunity and prosperity.

Canadian Electrical Association

As at present constituted, the Canadian Electrical Association is a geographical section of the National Electric Light Association, and as such its Class A membership is restricted to privately owned central stations. Owing to the rapid spread throughout the Dominion of the municipal-ownership propaganda, several of the larger manufacturers of electrical apparatus and appliances have expressed the opinion that provincially owned and municipally owned hydroelectric plants should be admitted to Class A membership in the Canadian Electrical Association on a par with privately owned plants. The principal point to be considered and discussed at the convention of the Canadian Electrical Association to be held in Toronto next week is whether it shall become a national, self-contained body, the membership of which shall consist of privately owned and publicly owned stations alike, or whether it shall continue as a geographical section of the National Electric Light Association with all the benefits and privileges appertaining thereto. Since the National Electric Light Association now returns to the Canadian Electrical Association one-half of the receipts collected from Canadian members, the formation of a purely Canadian association would result in a gain financially to the National Electric Light Association because the latter would still largely retain its Class A Canadian members, who would be loath to sever connections with the more powerful body. Theoretically there appears no reason why municipally owned and privately owned utilities may not discuss their engineering problems in common, but from a purely business basis there are well-recognized objections.

A Sensible Sales Policy

The common-sense and just policy of putting central-station appliance sales on a profit-producing basis, as outlined before the National Electric Light Association by its committee on merchandising, points once for all a clear course in the dilemma which for years has been threatening to involve the arms of the industry in a strife of internecine bitterness. If the central station is to sell energy-consuming devices—and there seems no good reason why it should relinquish a function so vital—then, as pointed out by Mr. T. I. Jones and his confrères of the committee, this branch of its business should be put upon a purely merchandising basis, with selling prices so fixed as to produce a profit over all costs. So obvious seems this conclusion that after reading the report one almost wonders why any honest issue should ever have existed here at all, unless on the narrow basis of the selfishness of those interested. Of the three alternatives offered—central-station price-cutting, abandon-

ment of the appliance-sales field altogether, and sales at a profit—certainly the committee has selected the sane and just course. In protecting its own interests the central station of to-day could never afford to call off its highly specialized commercial staff and to leave solely to the dealer and wireman the important development work of adding energy-consuming devices to its system. The public has long come to look upon the central station as a dependable adviser in its electrical problems. The customer, too, places additional confidence in the usefulness and durability of a device behind which the utility company stands. But the sale of an appliance at a fictitiously low price in order to benefit elsewhere from the sale of energy it consumes is hardly in accord with the modern spirit of equity which has its most literal expression in rate-making. To handle the average electrical stock involves an overhead charge of 22 per cent, and the committee wisely recommends that sale prices be set at an advance of 33 per cent over cost. The merchandising experience of years has shown that not price but selling effort controls volume of sales—an experience which is repeating itself in new-business departments every day. With maintained prices the interests of the outside dealer are protected, unhappy friction is eliminated, and valuable co-operation is secured in quarters where it is important. At a single stroke, therefore, adoption of this policy can transfer the appliance-sales department from the debit to the credit side of the ledger and, putting all hands at work in friendly rivalry, accomplish the widest possible distribution of appliances.

Electrically Operated Locks

The electrical installation at the locks and dams of the Charles River Basin at Boston, described elsewhere in this issue, illustrates in the fullest degree the convenience and reliability of motor service in the important work of passing vessels rapidly between large bodies of water at different levels, and indicates the possibilities of electric energy distribution on waterfronts crowded with shipping and traversed by heavy street railway and highway traffic. The improvements effected within the last few years at the basin are familiar to all visitors to Boston who have had time to see anything of the city's topographical progress, and it is interesting to reflect that the extensive applications of electricity at the harbor end of this beautiful and constantly freshening sheet of water have been made so unobtrusively that probably not one person in ten thousand passing the installation dreams that in and about the locks are fifty-two motors of nearly 400 hp combined rating, supplying the manifold needs of gate operation, pumping, drawbridge movement, capstan and signal service which are associated with the efficient administration of the plant. The volume of traffic passing through the locks required over 6000 openings in the last fiscal year, and the average time required to pass a vessel was about four and one-half minutes, thanks to the accelerating capabilities of electric motive power—the concentration of control in a single operating tower permitting by remote-control devices the simultaneous movement of separated apparatus—and the reliability of the energy supply from two central stations and the local electric railway feeders.

From the central-station point of view, the off-peak characteristics of the service are attractive, since by regulation of the War Department the lock openings must be outside the morning and evening rush hours on the railway system and since these to a considerable degree include the afternoon hours of heaviest demands upon the lighting systems which share in the supply of electricity. Again, the traffic is much lighter through the lock in the winter season, and while the demands for energy are intermittent, the actual investment required in generating equipment to handle such a load must be practically negligible. It is significant that the use of electric motors in place of hand operation on the filling gates of the small-boat lock cuts the time of locking a boat through from fifteen to three minutes, besides reducing the labor cost of such service by 33 per cent. There is no question that the saving in the installation as a whole by the use of the motor drive is so great as to make any other method of operation now unthinkable under the congested conditions prevailing in and about the northerly approaches to the city.

High-Tension Direct-Current Traction

One of the very important papers read at the joint meeting of the Institution of Electrical Engineers and the Société Internationale des Électriciens in Paris was that by Mr. L. Gratzmüller on the present status of electric traction with high-voltage direct current, abstracted in this issue. His discussion is in part theoretical, dealing with conditions which beset the design of motors for such service, and in part highly practical, in his treatment of existing installations. A very noteworthy feature of his treatment of motor design is the admirable generalization of motor theory so as to include in the fundamental matters dealt with all asynchronous machines whether of the direct-current or the alternating-current type. From this point of view his paper is peculiarly instructive and illuminating.

With respect to actual practice, Mr. Gratzmuller recounts the work that has been done by various companies in various parts of the world toward the realization of high-tension direct-current traction. Tried at first merely by putting ordinary 600-volt motors in series, the improvements in design which have come about through the use of commutating poles have rendered it possible to build powerful motors for much higher voltage. Mr. Gratzmuller is of the opinion that 1200 volts per motor is a value that can be reached with perfect safety, as indeed it has been here and elsewhere. One of the foreign installations which he records as actually in service works with 1500 volts per motor, and another with even 1800. Whether these pressures could be advantageously employed in motors of very large size in which the current to be commutated is great is another matter. The author thinks that 3000 volts direct current on the working conductor is about as high as is likely to be reached for some time. At this limit it is evident that very large locomotives cannot be conveniently utilized so long as the current must be taken from a suspended wire. Hence the indications point to the limitation of such practice to cases in which a third-rail gives the necessary current-collecting capacity. It is

therefore safe to conclude that, at least for some time to come, the direct-current high-voltage system will be developed alongside the single-phase and three-phase systems as is now the case, each system being selected with special reference to the work to be done.

It is notable that practically all the large electrical manufacturing companies, whether on the whole favoring one or another of these systems, actually do install any of them when occasion seems to render it desirable. Incidentally it appears that the difficulties of suitable speed regulation are far from negligible in using the high-voltage direct-current motors. Various ingenious plans for obtaining this economically have been developed. The battle of systems is likely to go on for some time to come. When long and important lines are to be considered high voltage on the working conductor seems to be imperative, voltage high enough in fact to enable powerful locomotives to be used without recourse to third-rail construction. At the present time this seems severely to handicap direct-current traction in this particular field, but it is evident that the last word on commutating-pole construction has not yet been said and it may turn out to be more satisfactory in high-voltage working than now seems likely. At all events experience has shown that thoroughly successful traction on a large scale can be carried out, conditions favoring, by high-voltage direct current, by the single-phase or by the three-phase system widely used abroad. The chief question now is which one of these is best fitted for a particular task of electrification. No one need hesitate in the present state of things at any of the engineering difficulties of heavy electric traction, provided only that he is willing to make the most of the methods available. The difficulties which now check railway electrification on a large scale are not technical but financial.

Long Distance Radio-Telegraphy

There have been many occasions upon which a ship setting out to sea has attempted to hold wireless communication for the longest possible time with some radio plant installed on shore. As a rule, the effort has been to determine the greatest distance over which signals could be heard or exchanged, and little attention has been paid to the reliability of signaling attainable at the end of the test or to the intensity of signals at distances less than the maximum. The two series of tests referred to by Mr. John L. Hogan, Jr., in an article on "Quantitative Results of Recent Radio-Telegraphic Tests Between Arlington, Va., and the U. S. S. *Salem*" in this issue, are almost unique in that the measurements taken from hour to hour have made possible an engineering study of the diminution of signal intensity as the distance between radio stations was increased. The data secured in 1910 were sufficient to permit the establishment of empirical coefficients to apply in a general law covering radio transmission, which is stated in the paper of Dr. Austin referred to, and the tests recently completed have given a number of additional relations, from which Mr. Hogan has extended the earlier work and evaluated the constants applicable to the most modern types of radio apparatus.

In the article in this issue it is shown that the same functional relation which had been fixed between attenuation, wave-length and shorter distances holds for separations up to 4250 km (2512 miles). The only great disagreements between measured signal intensities and those calculated from the theoretical relations occurred when the ship was not very far from Arlington, and therefore before absorptive effects were prominent. It is apparent that in transmission from ship to shore on 2000 m wave-length the agreement is not so good as on the longer wave, in the opposite direction, and this may indicate that the square-root law of the effect of wave-length upon absorption is not strictly accurate. Nevertheless, from the present data it would be unwise to overthrow the expression covering a mode of variation previously defined by work with other considerably different wave frequencies, since the few discrepancies may be attributed to the natural uncertainty of measurement caused by atmospheric and other conditions.

The marked responsiveness of the heterodyne receiver used, as compared to the simple electrolytic detector, and the great difference in intensity between night and day signals, even upon wave-lengths as great as 3800 m, are especially worthy of note. In addition to these, one of the most interesting points emphasized by a study of Mr. Hogan's paper is that bearing upon the intensity of signal required for regular radio communication. In Dr. Austin's computations of 1911 a received telephone current sixteen times as large as that necessary to produce a barely audible sound—which just permits dots to be distinguished from dashes—is taken as sufficient to allow "good working" between two stations. The more recent experience of radio engineers seems to indicate that a current slightly greater than this is desirable for receipt of messages even under favorable conditions of "static" and interference, while consistent communication through average disturbances requires very much larger received powers.

The computations indicating distances which may separate two intercommunicating high-powered stations of the design now installed at Arlington are based upon the average amplification of the receiver used. There should be considered the fact that this device seems to increase in apparent or effective sensitiveness as the received signals grow weaker, and therefore that even the largest distances quoted may be greatly exceeded by securing a signal multiplication of ten or twelve. Such values are stated not to be uncommon when the received waves become quite feeble, so that as this type of apparatus becomes more widely used great signaling ranges will doubtless be attained.

It is unfortunate that the great expense involved has prevented the making of such experiments as those described, for the purpose of determining the numerical relations of all the factors involved in long-distance radio work, and that the experimental branch of the matter has been made, perforce, a side issue. It is equally unfortunate, however, that the several interests which have had frequent opportunity for making such measurements have not done so. The continued publication of material of this kind will go far toward clearing up many little-understood phenomena, such as those of radio absorption by day and night over great distances.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Change in Management of General Electric Company

At a meeting of the board of directors of the General Electric Company held on June 13 Mr. C. A. Coffin, president of the company since its organization, resigned and was thereupon elected chairman of the board of directors. Mr. E. W. Rice, Jr., vice-president of the company, was chosen as the successor to Mr. Coffin. No other changes have thus far been made in the management of the company.

The Retirement of Mr. Coffin

By Thomas A. Edison

You inform me that Mr. Coffin has resigned the presidency of the General Electric Company and you ask for an expression from me. My opinion is that Mr. Coffin has for years been the principal asset of his company, a great personality, a master of modern business organization and truly one of the great captains of industry. For twenty years he has been promising me to take two hours off and come over to see my laboratory. But pressing engagements, etc., have delayed the visit. If he comes, I shall know that he really has resigned.

Mr. Coffin as a Leader

By Elihu Thomson

Thirty years ago Mr. Coffin became interested in the electrical industry then just opening up. His sagacity, business ability and splendid courage in the face of great difficulties, his fine personality, his faith in the future of electricity, his ever-ready help and encouragement, so inspiring to those who were endeavoring to solve the new problems, gave to the Thomson-Houston Electric Company up to 1891 its position as a leading organization in the electric field. When in that year the Thomson-Houston Electric Company and the Edison General Electric Company combined to form the General Electric Company, Mr. Coffin became its president for the simple reason that no other man existed who was so fully equipped and so competent for the position. How well he has met the arduous tasks and duties of his position during the past twenty years is evidenced by the growth of the organization itself. It is the earnest wish of his friends that he may live in health for many years to enjoy the relief which he now takes.

Mr. Charles A. Coffin

By E. W. Rice, Jr.

It was my fortunate experience to meet Mr. Coffin about thirty years ago. I remember vividly this first meeting and the happy impression which I then formed of his inspiring personality, an impression that has but strengthened and deepened with the passing years.

He was one of a group of capable business men of Lynn who purchased the control of the little electric company started by Professor Thomson in New Britain in 1880. This company had been struggling along for two years under most discouraging circumstances; its financial resources were about exhausted; the future was dark and uncertain; there was nothing but our childlike faith in the future of the industry to sustain us. At this critical time came the purchase by the Lynn syndicate.

We were amazed at Mr. Coffin's instant grasp of the business, engineering and manufacturing necessities and his wonderful faith in the magnificent future of the electrical industry. His influence seemed magical. Inspired by his intelligent enthusiasm, guided by his patient, wise counsel, difficulties vanished, work became a delight. Then began that loyalty and devotion to the upbuilding of an electrical enterprise the thrill of which can possibly be fully understood only by the fortunate participants.

The story of the constant growth of the company after its removal to Lynn and the addition of other organizations has been often told and is a part of the history of the industry. In the growth and development of the organization Mr. Coffin did everything possible to conserve that valuable asset, the human element—the inventors, salesmen, manufacturers and workmen. As a result, the new men were quickly absorbed and became as full of enthusiasm and loyalty as the "old employees."

The Thomson-Houston organization was largely active in the railway-traction and arc-lighting fields. Another great organization and business, the Edison General Electric, had meanwhile grown up based upon the inventions and engineering genius of Edison. Mr. Coffin clearly saw the great advantages which would result not only to the respective companies but to the electrical industry by a consolidation of these two organizations, and upon his initiative the union was finally accomplished. Within a few years after the consolidation complete unification was brought about with even increased loyalty, zeal and devotion to the new larger organization and to its enthusiastic leader.

Another important instance of his constructive ability was the agreement between the Westinghouse and General Electric Companies in respect to the exchange of licenses under their respective patents and inventions, by which an exhausting struggle over patents was terminated and millions of dollars saved from wasteful litigation. The most important result was the benefits which flowed from the fact that the engineers of both companies thus obtained complete freedom to select in every instance the best systems and design the forms of electrical machinery presenting the greatest advantage from both a mechanical and an electrical standpoint, which was of unparalleled advantage to the industry and to the public. I believe that the development of the electrical industry as we know it would have been delayed many years if this agreement had not been effected at that time.

Mr. Coffin has been without question the greatest single factor making for peace in the electrical industry. He was always quick to recognize the good qualities and work of the men of competing organizations and succeeded in changing hundreds of industrial enemies into the warmest of friends and companions. I consider him the greatest conservator of human energy in the electrical industry.

Mr. Coffin recognized from the beginning that the comprehensive development of the electrical industry was dependent fundamentally on securing the capital necessary for the growth and expansion of electrical undertakings, and his influence in educating investors to a correct appreciation of the value of securities of electrical enterprises has been

a most potent factor in bringing about the wonderful growth of the electrical public utilities which has taken place during the last thirty years, the service rendered by which contributes in such an important measure to the convenience and comfort of modern life.

While I cannot trust myself to do justice to his personal character, I am compelled to testify to the vivid impression made upon his close associates of many years by his quiet but wonderful courage in the face of the greatest difficulties and his uniform patience under the most trying circumstances. He naturally possesses all the intellectual qualities which popularly belong to great men, but greater than all is his compelling charm of personality and his deep sympathy for all that is worth while in human life and endeavor.

Career of the New President

In the year 1880 Edwin Wilbur Rice, Jr., was called upon to make that momentous decision which so many young Americans have to make. He had just been graduated with first honors in his class in the Central High School of Philadelphia. Two years previous to this time he had attracted the attention of Prof. Elihu Thomson, who then taught chemistry and mechanics in the high school, by his skilful amateur work in constructing telephone and telegraph instruments, induction coils and dynamos. Then the pupil fairly won the master's heart by his success in grinding and polishing glass specula and in silvering them by a new method orally communicated to him—a rare enough feat even after seeing it done many times.

E. W. RICE, JR.

Thus it happened that young Rice had free access to the shop behind the baker's store where the earliest Thomson-Houston arc-light machines were being constructed, and thus it happened that in the summer of 1880 he was forced to choose whether he should go through college, with the prospect of a career which bade fair to be distinguished, or attach himself and his fortunes to the then infant industry of electric arc-lighting. With that coolness of judgment which has always continued to be one of his distinguishing characteristics, Mr. Rice turned his eyes resolutely away from the attractions which a college course presented and became Prof. Thomson's assistant and confidant in the American Electric Company at New Britain, Conn., then newly formed to manufacture arc-lighting apparatus under the Thomson-Houston patents.

The two years that followed, while fruitful in technical development, were far from showing the business prosperity in the new enterprise which had been anticipated, and Mr. Rice, while acting practically as foreman of the electrical works, found time to wind armatures and otherwise to acquaint himself thoroughly with manufacturing details. Prospects grew brighter in the fall of 1882, when Messrs. H. A. Pevear, C. A. Coffin and Silas A. Barton came from Lynn to purchase a lighting plant and ended by buying a majority interest in the American Electric Company, which they transferred to Lynn and renamed the Thomson-Houston Electric Company. Then followed two or three delightful years during which Mr. Rice was permitted to devote his energies to experiment and invention, and during which his name began to be familiar in the Patent Office, often in conjunction with Prof. Thomson's, for radical improvements in the electrical art, though chiefly at this time in arc-lighting systems.

By 1885 the business acumen of Mr. C. A. Coffin, who had become associated with Messrs. Pevear and Barton on the removal of the works to Lynn, had begun to make itself felt in every direction, and the enterprise was growing with surprising rapidity. Under these circumstances the need of a superintendent of the works with an adequate technical knowledge of electricity began to be felt acutely, and Mr. Rice, though still considerably under thirty years of age, was asked to accept this position. If he hesitated for a moment, it was chiefly because his new field of labor would tend to break the chain of close association which had hitherto bound him to Professor Thomson. A short trial of the new duties was sufficient to show those about Mr. Rice that he was the right man for the place and also to convince him that his new responsibilities would not necessarily impair his fertility as an inventor. Under his able and tactful management work was systematized, production was hastened and costs were cut down. To constant-current arc-lighting were quickly added motor work, constant-potential, incandescent and railway work, while the alternating-current transformer system of lighting was developed. Of all this expansion Mr. Rice was keenly a part, growing as the work grew, keeping abreast of the world's rapid progress in electrical science, and in spite of his heavy daily task as superintendent, seldom missing an opportunity to transmute new theories into practical inventions.

From the few hundred who were employed in the Thomson-Houston factory at Lynn when Mr. Rice took charge in 1885, the number of hands had grown until 3700 were at work there in 1892, when the next great change in his career took place—the Thomson-Houston and Edison General Electric Companies being consolidated into a new concern known thereafter as the General Electric Company, with Mr. C. A. Coffin as president and Mr. Rice as technical director. To follow his career after 1892 would be to write a history of the technical department of the General Electric Company. On June 26, 1896, he was elected to the office of third vice-president of the company in charge of all its technical and manufacturing departments, eventually becoming senior vice-president and on the retirement of Mr. Coffin the unanimous choice of the directors as president.

It is worth while to look back upon the large and varied experience which Mr. Rice has had in the electrical field during the past twenty-eight years, during which he has been engaged, not in a subordinate capacity, but in positions where his word counted with that of only nine or ten other men in the world in picking out the path of least resistance for the advance of electricity in the arts. He has seen the flexibility of the arc lamp developed to meet almost every condition of electrical circuit. The responsiblity for making the crucial experiment of the West End Street Railway of Boston an electrical and mechanical success fell upon his shoulders. He has furthered the growth of long-distance electrical transmission of energy with its many difficult problems, and has followed closely the electrical and mechanical development of the polyphase motor, in which

he has personally done much to insure its successful operation in commercial service. He has attacked successfully the weak point in distributing systems of polyphase currents at high voltage by the invention of an oil switch and the cellular system for separating buses and circuits now so widely used and which resulted in a switching system at once safe and simple. To him is also due the present system of alternating-current distribution and its subsequent conversion into direct current through rotary converters so largely used by Edison companies. He has been instrumental in the development of steam turbines and has witnessed the final overthrow of the reciprocating engine by the steam turbine in large central-station systems, and their erection in sizes as large as 30,000 kw. In fact, it was he who caused the adoption of the Curtis type of turbine and its subsequent development by the General Electric Company. Owing to his faith in the tungsten lamp and its final triumph, he caused investigations to be pursued with a view of obtaining a more rugged filament, which finally resulted in the present metallic-filament tungsten lamp which has been such a boon to the electric-lighting industry and a conspicuous milestone in the development of the art. His inventive genius is partially indicated in the statement that there have been granted to him more than 100 patents. However, while himself thus fertile as an inventor, Mr. Rice possesses to a conspicuous degree the valuable faculty of directing the inventive ability of others to meet the cases that are constantly arising in the industrial development of the art.

Mr. Rice is a member of the American Institute of Electrical Engineers, the Institution of Civil Engineers and the Institution of Electrical Engineers of Great Britain, a member of the Engineers' and University Clubs of New York, the University Club of Boston and the Pilgrims. After the Paris Exposition in 1900 he was created Chevalier of the Legion of Honor. In 1903 the degree of A.M. was conferred on him by Harvard University, and in 1906 Union College honored him with the degree of D.Sc. Mr. Rice was born at La Crosse, Wis., May 6, 1862.

Government Suit Against Patent Monopoly

On June 9 United States District Attorney O'Brian filed suit at Buffalo, N. Y., in behalf of the Attorney-General against the Eastman Kodak Company, of Rochester, N. Y., alleging an unlawful monopoly in photographic cameras and supplies and praying for dissolution. Two corporate and four individual defendants are named in the bill. The Eastman Kodak Company of New Jersey is a holding corporation with a capital stock of $35,000,000. The government charges that it owns the majority of the stock of the Eastman Kodak Company of New York, Kodak Limited, a London corporation, and also of the Canadian Kodak Company.

The government also charges that the Eastman company has bought control of many of its competitors and continues to operate them as independent concerns, thus controlling, it is said, 72 per cent of the business. In order to enjoy the Eastman patents, so it is charged, jobbers and dealers are required to purchase Eastman supplies, and the petition also recites that resale prices are unlawfully fixed on various products patented by the company.

President George Eastman of the Eastman company is quoted as saying that his concern is willing to adjust its business methods to meet the government's charges, operating its retail houses under its own name in all cases and abandoning its exclusive sales policy. Regarding the last matter, Mr. Eastman is reported to have made the further statement:

"One of the main points of this policy (respecting dealers in our patented goods handling no other similar goods) has been to prevent the substitution of goods that were inferior to ours. However, desiring to avoid a long and expensive litigation, the waste of time of our most important men and the unsettling of normal business conditions, we are willing to meet the wishes of the government even on this point."

This action by the government is the first procedure against the fixing of resale prices on patented goods since the United States Supreme Court handed down its notable decision in the "Sanatogen" case on May 26 denying such right.

A. I. E. E. Convention Entertainments

The technical program of the next annual convention of the American Institute of Electrical Engineers, to be held at the Hotel O-te-sa-ga, Cooperstown, New York, June 23-27, was given in our issues dated May 10 and June 7. Twenty-four papers upon a wide variety of subjects of interest to the electrical engineering profession will be read and discussed. The following events have been arranged by the entertainment committee for the enjoyment of members of the Institute and guests during the convention:

Monday, June 23, 9 p. m., reception and dance in the ballroom of the Hotel O-te-sa-ga, to which all members and their guests are invited.

Tuesday, 2:30 p.m., preliminaries in golf and tennis tournaments. A ball game will also be played on Tuesday afternoon.

Wednesday, 10 a. m., an automobile trip around Otsego Lake for the ladies; 8 p.m., ladies' bridge tournament.

Thursday, 10 a.m., court golf tournament for the ladies; 2:30 p.m., finals in golf and tennis tournaments; 4 p.m., steamer excursion on Otsego Lake.

The committee is arranging for suitable prizes in the various tournaments. A prize will also be given for the largest fish caught during the convention.

Many of the members from the New York neighborhood will take advantage of the opportunity to travel by boat up the Hudson River to Albany. The night boat reaches Albany in time to make connection with the train which arrives at Cooperstown before noon.

Ohio Electric Convention

An unusually attractive program has been planned for the nineteenth annual convention of the Ohio Electric Light Association, which will be held at the Breakers Hotel, at Cedar Point, Ohio, on July 15, 16, 17 and 18. The first session will commence at 2 p.m. on Tuesday and will consist of an address by President J. C. Martin, of Wilmington, Ohio, the report of the officers, and an address and demonstration on "Cooking by Unity Load-Factor Electric Ranges," by Mr. Matthias Turner, of Cleveland, Ohio. The other sessions will commence at 9.30 each morning. On Wednesday, which is "commercial day," the following papers will be delivered: "Retention of Business of Dissatisfied Customers," by Mr. Thomas F. Kelly, of the Dayton Power & Light Company; "New Business," by Mr. J. E. North, of the Springfield (Ohio) Light, Heat & Power Company; "New Applications of Electricity as an Adjunct to New Business," by Prof. F. C. Caldwell, of the Ohio State University, and "Means of Developing and Diversifying the Present Load," by Mr. H. E. Armstrong, of the Tri-State Railway & Electric Company, of East Liverpool, Ohio. Mr. S. G. McMeen, president of the Columbus (Ohio) Railway & Light Company, will give an address on the subject "The Human Equation," on Thursday. Following his talk will be a report from the committees on meters and on long-distance transmission, by Messrs. A. H. Bryant and M. H. Wagner respectively. The fourth and last session will consist of addresses by Mr. James V.

Oxtoby, counsel for the Edison Illuminating Company of Detroit, on the subject of "Franchises," and by Mr. A. M. Seeger, of the Toledo Railway & Light Company, on "Illumination as a Commercial Product."

Entertainments of various sorts have been scheduled for the men and women who attend the convention. On Thursday evening the Sons of Jove will hold a rejuvenation, reunion and banquet.

International Association of Municipal Electricians

The eighteenth annual convention of the International Association of Municipal Electricians will be held at Watertown, N. Y., Aug. 19 to 22, with headquarters at the New Woodruff Hotel. Among the subjects to be discussed in the papers presented at this meeting will be fire-alarm and police signaling, electrical inspection, municipal lighting, electrolysis, joint use of poles, permissible voltages on overhead wires in cities, standardization of specifications for cables, and municipal ownership. A number of entertainment features are also planned for the delegates. For the convenience of those coming through New York City, special sleeping cars will leave the Grand Central Terminal at 9:30 and 11:30 p. m. Aug. 17 and 18, running through without change to Watertown. Mr. John W. Kelly, Jr., Camden, N. J., is president of the association, and Mr. Clarence R. George, Houston, Tex., is secretary.

Commercial Section Executives to Discuss Ways and Means

The executive committee of the Commercial Section of the National Electric Light Association will hold a meeting at Association Island, Henderson Harbor, N. Y., on Aug. 7, although it is expected that most of the members will spend the entire week on the island. At this meeting tentative plans for the year's work will be discusssed and many new features of Commercial Section work to be taken up during the year will be outlined. At the recent convention the small-company representation on the committee was increased, and it is the intention to devote much time and labor to the problems which confront the small stations during the coming year, under the régime of Chairman T. I. Jones, of the Brooklyn Edison company. Moreover, it is proposed to keep down the number of Commercial Section papers to be presented at next year's convention so as to give ample time for discusssions. An active campaign is now under way to increase the interest and membership in the Commercial Section, and the details will be presented at the meeting on Aug. 7. The plan and scope of the publication work of the section will also receive attention as well as the adoption of by-laws.

Five-Hour Outage on Ontario Hydroelectric System Due to Lightning

For the first time since the beginning of operations in September, 1910, the Ontario hydroelectric system experienced a serious and prolonged interruption on June 16, due to lightning. For fully five hours the entire district supplied by the Niagara transmission system of the Province was without electrical energy, and every industry and street railway within the 297 miles dependent for electricity on the Ontario hydroelectric system was stopped or discommoded and every householder using electricity inconvenienced. Interruption of service in Toronto occurred about 4:30 in the afternoon, while St. Thomas reported a break in the line at 2:20, and it was well on to 10 o'clock at night before the public lighting in the streets of Toronto was resumed.

A heavy storm passed over the country between Niagara and Toronto on Monday, and it is reported that two large insulators were struck on the line between Dundas and Port Credit. As is well known, the lines are in duplicate, but unfortunately both lines were struck, completely tying up the system. The western towns of Ontario—notably Berlin, Stratford, Waterloo, Preston, Bridgeport, Galt and London—were the chief sufferers, most of the towns along the Ontario lake front having competing service. In St. Thomas the newspapers were printed from the office of a journal possessing its own steam plant. In Toronto, where the local hydroelectric system has about 19,000 customers, the inconvenience was keenly felt, especially in stores, restaurants and theaters. The residents at West Toronto were left without any water owing to the interruption of service at the pumping station.

The Toronto Electric Light Company, Ltd., met the civic extremity by sending out three emergency crews and all available linemen to make temporary connections with its service wherever possible. Several theaters, hotels and other public places were supplied with energy, as well as a considerable number of merchants on Yonge Street, the principal business thoroughfare. As all street lighting in Toronto is on the hydroelectric system, the Toronto Electric Light Company could be of no assistance in this respect, and the entire city was in absolute darkness from sunset to 9:45 p.m. As a result of its public-spirited policy, the Toronto Electric Light Company, Ltd., has received many letters of thanks and also a number of new customers.

The Ontario hydroelectric system has no steam-power reserve, depending on superior construction for continuity of service. It was also realized at the outset that, if cheap service was to obtain, no steam reserve could be carried. No lines were broken, and the trouble was such as to necessitate inspection of the entire line before it was located and remedied.

Railway Electrical Engineers at Atlantic City

The semi-annual convention of the Association of Railway Electrical Engineers was held at Atlantic City, N. J., June 16, coincidentally with the conventions of the Railway Master Mechanics' and the Master Car Builders' associations in session there during the week.

Mr. H. C. Meloy, of the Lake Shore & Michigan Southern Railway, acted as chairman in the absence of Mr. D. J. Cartwright, of the Lehigh Valley Railroad, president of the association. President Cartwright's official address, which was read by Secretary J. A. Andreucetti, Chicago & Northwestern Railway, Chicago, pointed out the accomplishments of the railway electrical engineers' society during recent years. Up to this time twenty-seven of its recommendations have been officially adopted by the Master Car Builders' Association, and the transactions of the society have received the recognition and approval of high officials in the railway field. In 1910 there were only 3600 electrically lighted railway cars, which number has since been increased to 13,115 cars now in charge of members of the association, representing an expenditure of $9,500,000. Similarly the association membership, twenty-five in 1908, has grown to a present enrolment of 489.

In his own report Secretary Andreucetti spoke of the broadening of the association's work into other fields besides car-lighting, including shop electrification, arrangement of motor drive, illumination, etc. His business report showed the flourishing condition of the society.

Charging of Storage Batteries

Among the reports of committees submitted, chief interest was occasioned by that on methods of charging storage batteries for the electric lighting of passenger cars, presented by Chairman J. R. Sloan, Pennsylvania Railroad.

The committee outlined six schemes of straight-storage charging, four for use with head-end systems, and six for axle-generator service. The principles, characteristics and relative advantages of each plan were described, and the majority of the committee recommended the following as best suited for standard use: Straight storage—constant potential with ballast resistor; ampere-hour meters and shunt-trip circuit-breaker on each car. Head-end—constant potential with ballast resistance; ampere-hour meters and shunt-trip circuit-breakers on each car. Axle-generator—constant battery current with voltage control; ampere-hour meter on each car to indicate charge condition of battery and show whether terminal charging is necessary.

The majority report was signed by Messsrs. J. R. Sloan (chairman), F. R. Frost, H. C. Meloy, L. S. Billau, W. L. Bliss, W. E. Winship, H. M. Beck, H. G. Thompson and R. C. Lanphier. As a minority comment, Mr. R. Norberg opposed the straight-storage method recommended by the report, declaring that since the majority of batteries in car-lighting service are far from normal the scheme proposed might work more damage than good. While admitting the recommended method to be the best theoretically, he declared that for practical purposes under general service conditions the most desirable scheme is that of holding the charging current constant by adjustable resistance, while determining the ampere output by an ampere-hour meter. This meter should be designed to compensate for the cell efficiency, automatically shutting off the charge when completed.

Mr. J. H. Davis, Baltimore & Ohio Railroad, bore out Mr. Norberg's contention that the recommended method was chiefly of theoretical, rather than practical, value. Close record must be kept of the specific gravity of the electrolyte. The "fool-proof" qualities of the Edison battery recommend that cell, he thought, for railway use. Mr. L. S. Billau, Baltimore & Ohio Railroad, said that while no difficulty is experienced in getting operating reports, the labor and expense of obtaining these is sometimes excesssive. Mr. E. W. Jansen, Illinois Central Railroad, recommended that values of both voltages and resistances be included in the committee's report, and Mr. Edward Wray, *Railway Electrical Engineer*, requested more detailed information concerning methods. Mr. Joseph A. Andreucetti, Chicago & Northwestern Railroad, doubted the possibility of rigidly fixing any standardized battery-charging method under the varying conditions of practice.

Other Committee Reports and Papers

Brief progress reports were also submitted by the following members of committees: Head-end equipment, W. J. Bohan, Northern Pacific Railway; head-lamps, C. R. Sugg, Atlantic Coast Lines; illumination, L. S. Billau, Baltimore & Ohio; data and information, Edward Wray, Chicago; lamp specifications, J. L. Minnick, Pennsylvania Railroad; outside construction, H. M. Warren, Delaware, Lackawanna & Western Railway; standards, standardization and shop practice, E. W. Jansen, Illinois Central Railroad; wire specifications, W. A. Delmar, New York Central; terminal facilities, Alexander McGary, New York Central.

Mr. A. J. Sweet, of Milwaukee, Wis., illuminating engineer, has been retained by the committee on illumination to conduct a series of tests of illuminants, reflectors, arrangements, spacings, etc., which will be reported at the Chicago meeting in October.

At the afternoon session Mr. S. T. Dodd, of the General Electric Company, Schenectady, N. Y., delivered an illustrated talk on the gasoline-electric motor cars manufactured by his company, tracing their development in competition with other self-propelled units and describing the present 165-hp outfits which can attain high speeds and make runs of several hundred miles on a single charge of fuel.

Representing the Illuminating Engineering Society, Mr. G. H. Stickney, New York, appeared before the railway electrical engineers to ask for more active co-operation in the fields of illumination of cars and railway properties. He suggested joint meetings, the exchange of authors of papers, joint committees and representation on local committees. Mr. J. L. Minnick expressed approval of the plan, which, he said, would impart valuable information on lighting to the railway men, while at the same time it might give the illuminating engineers a more practical conception of railway requirements.

The annual convention of the Association of Railway Electrical Engineers will be held at the LaSalle Hotel, Chicago, Oct. 20 to 24.

The New York Electrical Society

A total of 275 members attended the visiting meeting of the New York Electrical Society recently held at the Woolworth Building. Mr. Charles E. Knox, consulting engineer, described briefly the electrical installation and elevator equipment of that building. The members were taken into the generating room, which contains two 500-kw, one 300-kw and one 200-kw reciprocating-engine-driven 250-volt generator unit. The building is equipped with a three-wire system, balancer sets being used to take care of the neutral current.

Two of the twenty-eight elevators were utilized to carry the members to the fifty-first floor, while a shuttle elevator carried them to the observation gallery on the fifty-fourth floor. The main elevators are of the gearless traction arranged for a speed of 700 ft. per minute. On account of the severe service to which the elevators are subjected use is made of an elaborate signaling system by means of which a dispatcher, whose sole duty is to start the cars at proper intervals, can communicate with each elevator operator at any time and thus prevent useless waste of time.

At the annual business meeting of the society held in connection with the visiting meeting the following officers were elected: President, Mr. H. H. Barnes, Jr.; vice-presidents, Messrs. S. S. Edmands, A. H. Lawton and Carl Schwartz; secretary, Mr. George H. Guy, and treasurer, Mr. Henry J. Hoeltge. Mr. Guy V. Williams was awarded the Barnes silver cup for securing the largest number of applicants for admission to the society during the season.

The secretary announced that Nos. 1 and 2 of the *Transactions* of the society have been printed and distributed, and two other issues will appear shortly. The publishing of the transactions represents a new and important departure in the society's activities.

No. 1 of the *Transactions* includes papers presented at the meeting of October, 1912, by Drs. Baskerville and Goldsmith, of the College of the City of New York, the respective titles being "The Chemistry of Tungsten and the Evolution of the Tungsten Lamp" and "Radio-Engineering at the College of the City of New York." The first-mentioned is of particular interest for its historical account of the development of the tungsten lamp. The paper by Dr. Goldsmith includes an illustration and description of the very complete wireless-telegraph equipment presented to the college by Mr. Gano Dunn.

The second issue includes a biographical sketch and portrait of the late Horatio A. Foster, Mr. Foster's paper (presented Nov. 25, 1912) entitled "Reminiscences of an Electrical Engineer," and an illustrated description by Mr. Carl Schwartz of the New York Central Terminal, a visit to which formed the program of the December meeting of the society.

The paper presented Jan. 30, 1913, by Dr. R. W. Wood, of Johns Hopkins University, on "Photography by Invisible Light" forms, with illustrations, the subject of No.

3. Issue No. 4 contains an illustrated account by Mr. William J. Hammer of the Rupert historical collection of incandescent lamps—more than 1000 in number—formed by the author, now the property of the Association of Edison Illuminating Companies, which has provided appropriate quarters for the collection in the Engineering Societies Building, where it may be seen by the public. This issue also includes the paper presented on the same date by M. Antoine Pollak describing the Pollak-Virag rapid telegraph which photographically records in letters the words of messages. The lecture by Mr. C. F. Lacombe, delivered at the March meeting, on New York City street lighting and fixtures is printed, together with numerous illustrations, in No. 5.

The April meeting furnished two excellent papers on flying machines, which form No. 6 of the *Transactions*. One of these, by Lieut. T. G. Ellyson, U.S.N., is of particular interest through giving a historical sketch of the development of the "flying boat" and accounts of its latest forms and achievements. The second paper, by Mr. E. A. Sperry, has for its subject the application of the gyroscope to the flying machine, the text being well illustrated.

The successful career of the New York Electrical Society since its organization in 1881 has abundantly justified its founders in the belief of the need of a society in New York City having for a purpose "to present in popular but none the less authoritative form the latest advances in the electrical and allied sciences and arts." This need has rather been heightened than otherwise since then by the establishment there of many purely technical societies, the work of which the New York Electrical Society admirably supplements by a popular treatment of many subjects that these bodies deal with primarily from the more strictly technical point of view.

Now that its *Transactions* are being printed regularly, there is a prospect that the society will receive the additional support necessary to make it definitely an institution like those in London, Paris, Berlin and elsewhere in Europe. The latter have become celebrated for their courses of lectures appealing almost equally to laymen and men of scientific pursuits. It is expected that, as a result of the efforts and example of Retiring-president H. L. Doherty, supplemented by the generosity of Ex-vice-president Willard E. Case, in publishing the *Transactions*, the society will receive the larger support which alone is needed to permit it to attain easily the rank of its successful sister societies in European cities.

Joint Meeting of British and French Electrical Engineers at Paris

A joint meeting of the British Institution of Electrical Engineers and the French Société Internationale des Électriciens was held at Paris May 21 to 24. After the visitors had been welcomed by M. Berthelot, president of the French society, the following six papers on electric-traction subjects were read in abstract and discussed.

High-Tension Continuous-Current Traction

In a paper by Mr. L. Gratzmuller were discussed the possibilities of development of high-tension direct-current traction systems. After sketching the history of such systems, the general problem was considered under the several heads of high-tension generation, use of overhead trolley conductors, motors and accessories, control, safety, etc. At 1200 volts and above, the motor-generator with its increased number of poles becomes available for generation. The cascade converter may be regarded favorably up to 10,000 to 12,000 volts. Its operation is excellent and its starting and compounding easy. The rotary converter is available for ranges up to 1200 volts. A dynamo with a single commutator will operate satisfactorily up to 1500 volts, or indeed at 3000 volts by adding a second winding and two commutators or else by means of putting two machines in series.

Railway-type mercury rectifiers are now being perfected and such apparatus with ratings up to 300 kw already exist. Since the fall of pressure in these tubes is constant, the efficiencies obtained at high voltages are nearly unity. Pressures of 3000 volts continuous current are likely to be the safe limit for some time to come. But since at this pressure 500 amp is equivalent to a power of only 1500 kw, it appears that powerful locomotives can be utilized only where a third-rail is installed to provide necessary surface and contact pressure.

The author also presented a theoretical and mathematical analysis of asynchronous motors used for railway operation, discussing problems of their design, distributed compensating windings, inclosed motors, semi-inclosed motors, etc. The paper includes a tabulation of practical installations of high-tension direct-current railway apparatus in America and on the Continent. The highest voltage listed is that of the Butte, Anaconda & Pacific Railway, on which road 121 miles of track are electrified at 2400 volts line pressure.

Single-Phase Traction

In a paper read by Mr. Marius Latour on single-phase traction various mechanical considerations, design of overhead conductors, etc., were discussed, special attention being paid to the subject of motors of both the repulsion and the series type. The motors experimented with by the Compagnie du Midi have included the well-known Westinghouse series type, the Brown-Boveri simple repulsion motor, the A. E. G. compensated repulsion motor, the Jeumont series motor with a transverse local field for compensating the electromotive force of short-circuit under the brushes, and the series motor with an elliptical field built by the French Thomson-Houston Company. On account of its weight the repulsion motor is found inferior at frequencies of 15 cycles per second. Owing to its smaller number of poles a greater amount of iron is required in this type of motor, with, consequently, less advantageous use of the material.

Electrification of the Chemin de Fer du Midi

In a paper by Mr. M. Jullian were described the plans for the electrification of the Chemin de Fer du Midi. The French government will defray the expenses of the hydroelectric power plant, pipe lines, power-station buildings and substations, while the Compagnie du Midi will furnish the hydraulic and electrical machines and their accessories. The lines to be constructed have very steep gradients, which constitute one of the main factors that led to electrification. The practicable speeds range from 70 km to 60 km per hour. Sixteen-cycle, 12,000-volt single-phase energy is to be used for operation. Of the six types of overhead equipment, four are of the simple catenary type, the fifth is of the double-catenary type, and the sixth is of the rigid type.

The rolling stock consists of both locomotives and motor cars, the locomotives being especially intended for hauling long trains coming from non-electrified sections of the system. The locomotives have three driving axles, and a leading axle at each end. In the test locomotive, which weighs 86 tons, current is taken from the line by two pantographs. An induction regulator effects the control, thus eliminating contactors. The working of this regulator has given thorough satisfaction. The motors used are of the Latour series-repulsion type, starting as repulsion units and changing to series operation automatically when 15 miles per hour is reached, which is the speed corresponding with synchronism. Each motor is rated at 400 hp for continuous service or 500 hp for one hour.

Electrification of the Paris Suburban Lines

Mr. A. N. Nazen presented a paper descriptive of the electrification plans for the State railway suburban system in the vicinity of Paris. A study of traffic conditions, rush

hours, seasons, etc., has led to the use of a single type of electric car carrying 100 passengers including "straphangers." The author pointed out that the single-phase system affords considerable simplification in distributing arrangements by the use of static transformers in place of rotary-converter substations. It also accomplishes a saving in the number of attendants, improved efficiency and freedom from electrolysis troubles. With the direct-current system the equipment of the coaches is much lighter and less cumbersome, the acceleration is more rapid and the motors are more efficient. This system is also safer, since the current does not have to be taken above the floor of the car. The power house will be required to furnish 400 to 500 motor coaches with 650-volt direct current through a third rail paralleling the track. The substations will receive this energy as three-phase, 25-cycle, 15,000-volt alternating current. The third-rail collector shoe is to be of the under-running type. By the aid of an interesting control system a certain variation is permitted in the voltage of the direct-current supply.

Railway Electrification Problems in the United States

A paper by Mr. H. Parodi was devoted particularly to financial and operating results of railway electrification in America. The subject was divided under the three heads of suburban lines, main-line service and mountain railways. Among the tabulations of data given were an estimate of the cost of the New York, New Haven & Hartford single-phase electrification, an account of the working expenses of the New York Central electrification, etc.

From curves presented by the author it was shown that as the weight increases the cost of steam traction rises much more rapidly than does the cost of electric traction. The cost of maintenance and repairs to electric locomotives does not, on the other hand, seem to be directly affected by the gradient or by the drawbar pull. Thus there is a certain weight above which electrical working is much more economical than steam working.

Other interesting considerations result from electrification. With regenerative braking, track maintenance and brake-gear up-keep have been found to be reduced. Long gradients can be descended almost without the application of mechanical brakes. The saving in up-keep and repairs appears to be sufficient to pay for a considerable part of the initial cost of electrification.

Petrol Electric-Motor Vehicle

A paper by Mr. J. B. G. Damoiseau contained a brief historical sketch of the earliest self-contained electric-propelled vehicles, which used steam prime movers, and was devoted largely to detailed descriptions of the gasoline-engine-driven motor vehicle of the Société Anonyme de Locomotion Électrique, the North Eastern Railway Company, the Dion-Bouton system, the Société Westinghouse du Havre, the Bergmann Elektricitäts-Unternehmungen Aktien-Gesellschaft, the Allgemeine Elektricitäts Gesellschaft, the General Electric Company, the British Thomson-Houston Company, the Swedish State Railway, the Pieper system and the Thomas petrol-electric system.

The advantages and disadvantages of the various types were enumerated and a discusssion was included of the best fuels to be used. Initial cost and cost of operation were also discussed, together with figures giving the total expenses of running petrolt-electric vehicles. The four types of independent motor vehicles now available are those driven by steam, storage batteries, gasoline engines with mechanical transmission and gasoline engines with electric transmission. Storage-battery-driven cars, declared the author, have not been abandoned, and gasoline engines with mechanical transmissions are not flexible. The desirable characteristics displayed by the gasoline-electric cars emphasize, however, the shortcomings of the steam units, so that if the use of independent motor vehicles continues to develop gasoline-electric cars may preponderate.

Discussion

With Mr. W. Duddell in the chair, the discussion was opened by Mr. Mazen, who explained that the problem of electrifying the suburban lines of the Ouest État Railway was largely governed by the fact that the rush-hour traffic is about eight times that of the slack hours, whereas the usual ratio on suburban lines may be regarded as 3 to 1. The ease with which the power of the trains could be varied was of importance, consequently motor coaches have been employed, without trailers. For the Ouest État road, the newest trains will have four-motor coaches, totaling 640 hp per coach, which is equivalent to 9 hp per ton. Concerning the question of single-phase versus direct-current operation, Mr. Mazen admitted that single phase with an overhead conductor is excellent for single track and light traffic, but with large stations and several lines of rails the advantage is neutralized. But even in the case of ordinary double-track lines engineers are opposed to overhead construction, especially trolley wires suspended from span wires, for in the event of a derailment two or three posts knocked down would stop the whole line and temporary single-track working during the emergency would be impossible. At Batignolles and St. Lazare on the Ouest État system there are twenty and thirty lines of track respectively. Each track must be absolutely independent of the other, which is always posssible in third-rail operation.

Mr. Robert T. Smith spoke chiefly on Mr. Parodi's paper, which, he said, was of particular value in showing why the electrification of railways offers a different problem in the United States from that in Europe. For suburban lines the engineering problems of electrification have been solved, and merely the commercial problems remain. In the case of hilly districts there is a critical gradient above which electric driving will always pay. In Mr. Smith's opinion either direct-current or single-phase is better than three-phase owing to the series characteristic torque obtained. Recuperative braking does not spoil the single-phase motor in other respects. There is an immediate future for electric traction for mining traffic in hilly districts. A 3500-volt direct-current line will be started in England soon. For general purposes, said the speaker, the actual strength of the drawbar is the limiting factor. Averaging 12 tons, this corresponds to a train weighing 2500 tons to 3000 tons.

Mr. Robert Hammond, speaking in French, offered his thanks and congratulations to the authors of the six French papers. The question of electrification, he said, is entirely an economic one, and he considered that it was largely dependent on plant costs.

Mr. Bochest spoke on Mr. Damoiseau's paper. He referred to the pioneer work of Heilmann and pointed to the large variety of uses which exist for "electric coupling." For the turrets on warships, for instance, a range of speed of 1:300 is desirable, while the masses to be moved are enormous. In such a case there might be a saving of 30 per cent in fuel by using electric drive.

Mr. Marius Latour said that since the contact surface on the commutator depends on the frequency, there is no doubt that the cost of maintenance of a 25-cycle system is nearly double that of a 15-cycle system. He contended that the use of auxiliary poles in single-phase motors introduces no complications. The single-phase system requires heavier locomotives but affords the advantage of a single contact wire. Mr. Latour regretted the separation of single-phase systems into two sharply divided schools of practice and advocated a combination of the best points of all the methods. He touched briefly, but without appearing very sanguine, on the ultimate possibility of employing a rotary converter on the locomotive, so as to enjoy the combined advantage of high-tension single-phase at a comparatively high frequency on the trolley, and the direct-current motor

for driving. As to the immediate practical application of the mercury-vapor rectifier he was not very optimistic either but he cited a case in which a 1200-volt, 1000-amp mercury rectifier had been in continuous use for seven days.

Mr. Gratzmuller expressed belief that the repulsion motor might now be ruled out of court and that the field was left to the series compensated motor. The advantage of single-phase over high-tension direct current amounts to only 15 per cent. He recommended the use of resistances to diminish the emf between short-circuited segments, since in this way the size of the commutator can be enormously reduced. By placing the resistors in supplementary slots a satisfactory arrangement is secured without increasing the size of the armature.

Mr. Gratzmuller said that a 420-volt Westinghouse single-phase motor has a contact surface of the same order as a 500-volt direct-current motor. The advantages of alternating over direct current, he concluded, are recuperative braking and the possibility of varying speed without breaking the circuit. Mr. Gratzmuller added that he had proposed and patented a transformer which could be carried on the locomotive to convert single-phase into three-phase. A very simple method would be to employ a squirrel-cage rotating transformer and to regulate by rotating the brushes, but he did not recommend this.

Mr. Parodi, who next spoke, said that he was not an opponent of single-phase operation, but felt skeptical about accepting casual figures and statements.

Mr. Girousse, of the French Post Office, referred to his system for neutralizing disturbances in telegraph circuits. It deals, however, merely with the fundamental wave, and does not remove noises due to harmonics.

Mr. W. Slingo, of the British Post Office, said that the British telegraph circuits would be particularly liable to disturbance owing to the high speeds at which they are worked. The risk to railway signaling circuits with earth return is also great. In London the trouble was avoided by conversion to common-battery working. The problem seems to be how to divide the earth between the telegraph and traction engineers. If single-phase harmonics could be avoided, there would be no difficulty in overcoming the other effects. Tests on a telegraph circuit 20 ft. away from a 70,000-volt electric railway line, but running parallel to it, showed potentials of 600 volts. By interposing a parallel earthed wire this pressure was reduced to 50 volts. In another case a telephone wire broke off and set fire to the grass on which it fell owing to the sparking of the induced current.

Mr. Mazen, engineer-in-chief of the Ouest État railway emphasized that the correct policy for the railways is to obtain their energy supply from a central station and not to generate it themselves.

Mr. Maurice Leblanc next read a paper on the subject of "Three-Phase Current." This was a long review of present practice and recent developments and was read from manuscript. The paper is reserved for publication in the *Bulletin* of the Société Internationale des Électriciens. There was no discussion.

The Neon Lamp

On Saturday the proceedings opened with an interesting lecture by Mr. Georges Claude on luminescent neon tubes. Mr. Claude explained that an electrical discharge passes easily through neon, the ratio of the voltages required for a discharge across the same distance in air and neon being respectively 100 to 13. Unfortunately, however, the neon spectrum contains no blue lines. Another difficulty is that impurities escaping from the electrodes will prevent the neon from being set into luminous vibration. This latter trouble is overcome by purifying the neon with charcoal cooled by liquid air. The electrodes require large surfaces to prevent their volatilization. Such tubes exhibit lives beyond those of incandescent lamps. Compared with the Moore tube, the voltage required is only about one-third and the candle-power intensity is greater, being 20 candles per meter instead of 60. The efficiency is also better, being 0.6 instead of 1.7 watt per candle.

To overcome the reddish color of the light, neon tubes and mercury-vapor tubes are used in conjunction. Here another difficulty occurs, since, while neon tubes require high-tension alternating current, Cooper Hewitt tubes use continuous current. In place of ordinary mercury vapor, Mr. Claude uses for his "correcting" tubes tubes containing some neon and some mercury. The combination gives an illumination of an agreeable color, at an expenditure of from 0.8 watt to 0.9 watt per candle.

Wireless Telegraphy for Time Signals

In a paper by Commandant G. A. Ferrié the more general use of wireless telegraphy was advocated for distributing time impulses, since by this method all intermediaries are eliminated between an observatory and the clock to be set. Wireless transmission of time, by reason of its general applicability and accuracy, is far superior to all other systems. Wireless signals radiated in all directions with the velocity of light can be received simultaneously on land or sea for considerable distances by all observers having clocks to regulate. The author described the system employed at the Paris Observatory where connection is made between a special clock and the Eiffel Tower wireless system. An ordinary unskilled person can estimate the difference, within 0.5 second, between the time indicated by his clock and that corresponding to the signals heard in the telephone of the receiver. With practice one can even estimate to 0.25 second, and with mechanical means accuracies of 0.1 second are obtained.

The Eiffel Tower plant at Paris and the Arlington government station at Washington are now being used to determine the difference of longitude between the two cities with the greatest possible accuracy. Despite the distance and the low powers of the stations, signals have been interchanged and on one occasion a complete conversation was carried on between two stations. The signals will be received by means of photographic galvanometers with a rapid and uniform swing superimposed by the vibrations of a tuning fork, thus making it posssible to measure with acccuracy to 0.001 second. This will enable the observers to determine the speed of transmission to two significant figures.

Automatic Accessories in Manual Telephone Exchanges

Among the promising developments of mechanical switching devices to manual telephone exchanges, as pointed out in a paper by Mr. W. Slingo, are: (1) apparatus for evenly distributing traffic over a number of operators' positions; (2) a device for improving the transmission conditions on "B" positions where more than one call wire is terminated; (3) equipment for selecting and isolating outgoing call-wire circuits in cases where several call wires are used for operating a very large group of junction circuits.

The paper described details of selective apparatus for distributing traffic. On groups of outgoing call wires between busy exchanges trouble has been experienced as a result of confusion during the busy periods owing to operators interrupting each other and also owing to the delay caused by "A" operators in finding slack call wires. To remedy this a mechanical device known as an outgoing-call selector is given each operator. When she depresses her call-wire key the switch rotates until the wipers find an idle "B" wire to which the "A" operator can pass her call.

Discussion

Mr. G. H. Nash, chief engineer of the British Western Electric Company, alluded to the difficulty of differentiating between the kinds of service mentioned by Mr. Slingo,

since the operator does not know who is the calling subscriber. To make provision for this he proposed a signal-lamp board arranged to be visible over the entire exchange. Mr. Nash also pointed out that the operator should save about one second per call where the traffic distributor is employed, and that in consequence the equipment of the operator's position might be increased by three or four cord circuits. The next step would be to wipe out the multiple altogether.

Entertainment, Visits to Works, Etc.

As a feature of the meeting, two of the largest generating plants in Paris were visited, namely, the St. Denis station and the so-called Triphase at Asnières, which latter however contains a large proportion of two-phase equipment as well. The St. Denis plant, a description of which has been published in these columns, is the larger of the two stations. Considerable interest was evoked by an 11,000-kw Brown-Boveri turbine set recently installed there. It is a 25-cycle machine generating at 10,250 volts and running at 750 r.p.m., and it has an overload capacity of 15,000 kw for half an hour. The other visits of the delegates included the tramway and railway depots and car sheds of the Compagnie Générale des Omnibus de Paris, the Metropolitan Railway and the Nord-Sud Railway and also the wireless installation of the Eiffel Tower.

"Home Rule" Versus State Control of Illinois Public Utilities

An interesting public hearing was held on the evening of June 16 in the Capitol at Springfield, Ill., by the committee on public utilities of the State Senate. The question under discussion was the adoption of the Rapp bill creating a public-utility commission for the State of Illinois. This bill was originally drawn to cover interurban utilities, such as railways, telephone and telegraph service, while permitting cities of over 20,000 population to elect whether they should come under commission control as to local utilities, like gas, electric service, water supply and local telephone and street-railway service. However, the lower house cut out Article 6, containing this provision, making it a straight state-wide public-utility-commission law.

This action was extremely distasteful to the city administration of Chicago, which has had municipal regulation of utilities for the last eight years. A special meeting of the City Council was held on June 16, beginning at 9:30 a.m. Resolutions favoring "home rule" of public utilities and the restoration of Article 6 were adopted. It was also voted that all members of the City Council be urged to go to Springfield later in the day to present the city's case. In the brief debate Alderman Cullerton made the point that the city receives between $900,000 and $1,000,000 a year as compensation from local utilities.

Mayor Harrison, several members of his official family and about forty of the seventy aldermen went to Springfield during the day and appeared at the public hearing in the Senate chamber in the evening.

Senator Glackin, of Chicago, chairman of the Senate committee on public utilities, presided at the meeting. He is in sympathy with the "home rule" idea, and so declared himself in opening the meeting. He asked whether the Legislature was afraid to trust the people to control their own local affairs. He said that he expected the Governor to veto any measure opposed to home rule. Chicago had one-half of the utilities of the State and looked to the Senate for protection, he said.

Mr. W. H. Sexton, corporation counsel of Chicago, gave a history of the present legislative situation. He asked for home rule for Chicago, defining home rule as control by the City Council and not by a municipal commission.

Mayor Carter H. Harrison, adroit and self-possessed, made a strong appeal to the Senators to permit Chicago to retain its present system of municipal control. It would be reactionary, he said, to take away from Chicago home rule of public utilities. The Mayor thinks that the city has exercised its discretion well and cited the traction settlement ordinances of 1907, which have brought $11,000,000 into the city treasury. He declared that traction conditions in Chicago compare favorably with those in Milwaukee and New York—cities where state-commission control obtains. Further, Chicago has obtained for itself 80-cent gas, and the Mayor has no doubt that a satisfactory settlement will be reached with the Commonwealth Edison Company in the pending readjustment of electric-service rates.

The Mayor was asked many questions. To Senator Walter Clyde Jones he said that no doubt a municipal commission or bureau would be created by the City Council unless adverse legislation prevented. Senator Dailey, of Peoria, cross-examined the Mayor as to political party pledges and as to possible conflict between state and municipal control as in the case of local and long-distance telephone traffic, for instance. Mayor Harrison expressed himself as welcoming state regulation of interurban utilities, such as railways, telegraphs and telephones, with home rule for all municipalities in the State, large and small. There would be no conflict, he thought.

Alderman Richert, chairman of the finance committee of the Chicago City Council, said that the men composing that body, each representing from 60,000 to 75,000 constituents, could be trusted.

Alderman Charles E. Merriam, the leading independent of the Chicago City Council, who is also professor of political science in the University of Chicago and widely known as a scholar in politics, supported his colleagues unreservedly on the home-rule proposition. He explained the *modus operandi* of municipal regulation in Chicago through the Council committees on local transportation and gas, oil and electric light. He believed that the city had secured better results than would have been obtained by a state commission, and cited the recent telephone-rate regulation in proof. A state commission would have less accurate knowledge of local conditions. He made the statement that City Electrician Palmer's report on electric-service rates recommended a bureau of inspection of electrical service. The public utilities of Chicago are capitalized at $500,000,000 and have a combined gross income of $100,000,000 a year. However, the city has not the power as of right to inspect the books of these corporations and to make physical valuations. The city, he thought, should have this power.

Governor E. F. Dunne was the last speaker. He expressed his belief in the principle of regulation of public utilities. He made his campaign largely on this issue. After election he aided in drafting the so-called Rapp bill. The Governor said that he sympathized strongly with the home-rule sentiment, not in Chicago alone, but in other Illinois cities. Chicago had been quite successful in municipal regulation. Large cities were better able to make rate investigations than small ones, having greater means and resources. A state commission was particularly useful in protecting small cities from the great utility corporations. The sentiment of Chicago should be respected. The Governor made it clear that he favored the bill as originally drawn, rather than as amended by cutting out Article 6, but he did not say that he would veto the bill if the Senate passed it as amended by the House.

The committee adjourned to meet at the call of the chairman. As the Legislature is to adjourn on or before June 21, it was still uncertain when this account was written whether the Rapp bill would be enacted into law at this session.

The bill was passed to second reading in the Senate on June 17, without reference to a committee.

Public Service Commission News

MICHIGAN COMMISSION

In granting the Northern Michigan Power Company authority to do business in the State, the Michigan Railroad Commission laid down the principle that capitalization must be based on investment rather than upon the earning power of the company. Application had been made for incorporation with a capitalization of $10,924,166, but the commission decided that $9,054,542 would be sufficient for the purposes of the company in covering its investment. Authority to pay banking and brokerage fees was refused. The value placed on the flowing rights was not accepted, and the sum for this investment was placed at $1,450,000, instead of $2,265,000, as asked. Sufficient funds were also allowed for expenses until the property is self-sustaining and capable of returning some profit on the original investment.

This company was originally organized to build a power plant on the Sturgeon River for the purpose of furnishing the copper-mining section of the upper Michigan peninsula with energy. The commission has sought to prevent the issue of more securities than is actually necessary to put it into good operating condition. It asserted that in the past stock and securities were issued up to the limit of the earning capacity of many companies and that the commission was established to prevent this practice. Lands and properties, the commission said, should be capitalized at a fair market value and the company should have an allowance to cover time and efforts between the dates of conception of the idea and completion of the plant.

OHIO COMMISSION

The Sandusky Gas & Electric Company has appealed to the commission from an ordinance passed by the City Council of Sandusky reducing the charges for energy. The present rate is 8 cents per kw-hr. for the first three units and 5 cents for all above that. The new ordinance makes a flat rate of 5 cents up to 30 kw-hr. and 3.5 cents for all above that amount.

MARYLAND COMMISSION

The Maryland Public Service Commission has received from its counsel an opinion in which the plan of the Consolidated Gas, Electric Light & Power Company, of Baltimore, to permit customers to purchase electrical devices and appliances by crediting the deficit on minimum electrical charges on the appliance purchase price is condemned. The opinion was the result of a protest from a user of electricity against having to pay $2.20 in addition to what he had already paid for his electrical energy during the past twelve months. The company claimed that the consumer had a contract under a plan making a minimum charge of $1 a month, and inasmuch as he had used only $9.80 worth of energy during the year, it claimed $2.20 due on the contract. The company offered this consumer the privilege of buying an electric appliance and agreed to credit the $2.20 to the purchase price, and in his opinion the commission's counsel says that the consumer is liable for the $2.20, but he scores the company for offering to apply that amount on the purchase of an appliance.

NEW YORK COMMISSIONS

The Public Service Commission for the Second District announces that it has by order entered June 12, 1913, required further and large reductions in telephone toll rates between points in the city of New York. The reductions now to go into effect provide a common 5-cent subscribers' toll rate between Manhattan, Melrose and Tremont, on the one hand, and all of the city territory on Long Island except Bay Side, Hollis, Springfield, Far Rockaway and Hammels, to which the rate will be 10 cents. Corresponding reductions are made from the upper Bronx. The commission commends the telephone company for its response to the investigating order, as the result of which numerous reductions in subscribers' toll rates, aggregating a large sum, will be effected. Such action has been taken by the company without insistence on regular procedure in the case, with the submission of sworn testimony, thereby avoiding the expenditure of much time and labor in public hearings and the compilation of documentary evidence.

WISCONSIN COMMISSION

In deciding against the Appleton Water Works Company in its appeal from a ruling of the commission, the Supreme Court has laid down some important principles for the valuation of a public utility plant. In its appeal the company contended among other things that the commission in fixing the value of the property for the purpose of sale had not included an allowance for the indeterminate permit which the company had accepted in place of its franchise and that no allowance for going value had been recognized. In regard to the question of going value the court held that it had been considered by the commission in arriving at its estimate inasmuch as the following facts had been carefully gone into: the estimates of the engineers, not only those as to the cost of the reproduction and its value based on present prices but also those based upon the average of prices for five years; the testimony given in the rate case showing inadequacy in the present plant to meet the reasonable demands of the public service and the necessity of the immediate expenditure of a considerable sum to make the plant reasonably efficient; tabulated statements furnished by the company in the rate case which tended to show that the revenues of the plant had not been sufficient at any time to give more than an insignificant return upon the investment; complete information as to the condition of the physical property, the attitude of the public toward the concern and the probable growth of the city.

Current News Notes

NO REHEARING IN THE RESALE CASE.—The United States Supreme Court has denied an application for a rehearing in the so-called "Sanatogen" case, or Bauer Chemical Company versus O'Donnell, in relation to the right to fix resale prices on patented articles. The decision, which was quoted at length in our issue of June 14, stands as rendered and forbids such a practice where the purchaser secures full title to the patented article at the time of purchase.

* * *

EXAMINATIONS FOR ELECTRICAL ENGINEERS.—The United States Civil Service Commission announces a competitive examination for senior electrical engineers to fill vacancies on the staff of the Interstate Commerce Commisssion. Salaries for these positions range from $3,000 to $4,800, and from $1,800 to $2,700, with expenses. Applicants should have a thorough technical training, with several years' practical experience in construction and operation of electrical properties, and should be "active, intelligent and discreet, and of good speech and manners." Applications must be filed before July 21.

* * *

EXPERIMENTS IN TIMBER PRESERVATION.—The Forest Service, United States Department of Agriculture, has just issued Bulletin No. 126, entitled "Experiments in the Preservative Treatment of Red Oak and Hard Maple Cross-Ties," by Mr. Francis M. Bond, in charge of wood preservation. This is a ninety-two-page publication with nine plates and twenty-six illustrations, describing in great detail the behavior of oak and maple ties, treated according to various preservative processes, and installed for observation in a test track laid in 1911 in Wisconsin. The author presented a series of fifteen conclusions and believes, in the absence of contrary evidence, that the same conclusions can be applied to other hard woods.

Electric Vehicles in Ohio.—Altogether 3610 electric vehicles are registered in the State of Ohio. Of this number Cleveland leads off with 1838, and other cities have the following: Columbus, 459; Toledo, 367; Cincinnati, 238; Youngstown, 116, and Akron, 99. The electric vehicles make up approximately 6 per cent of the total number of automobiles in the State.

* * *

Electricity on Farms in Southern Idaho.—The rapidity with which the farmers in southern Idaho are adopting electricity to general uses on the farm has compelled the Great Shoshone & Twin Falls Water Power Company to construct many miles of new line during the early spring. Practically 75 miles of additional new lines are now being constructed or will be built for this purpose. The company has approximately 400 miles of high-tension lines in southern Idaho, all of which are situated in a progressive, rapidly growing agricultural community.

* * *

New York Electrical Exposition, Oct. 15-25.—An automobile or motor show will be held in conjunction with the New York Electrical Exposition to be given in the New Grand Central Palace, New York City, Oct. 15 to 25. Among the features promised for this year's exhibition will be the latest industrial electrical apparatus, therapeutic devices, electric vehicles, safety equipment, applications of electricity in agriculture, central-station and United States government displays, and a reproduction of the display made by Mr. Thomas A. Edison at the Paris Exposition of 1889. The general offices of the Electrical Exposition and Motor Show of 1913 are located at 124 West Forty-second Street, New York.

* * *

Denver Electrical Show, Oct. 4-11.—During the week of Oct. 4 to 11 an electrical and industrial exposition will be held in the Denver (Col.) Auditorium, free use of which has been granted the Colorado Electric Club by the Mayor of Denver. This exposition, which will be given under the Electric Club's sponsorship, is part of the club's present publicity campaign, which is intended to bring electricity and electrical men more prominently before the public and to keep them there. The Denver Auditorium contains 42,000 sq. ft. of floor space. Exhibit booths will be uniform in size and arrangement, each containing 122 sq. ft. Mr. L. M. Cargo, 1052 Gas & Electric Building, Denver, is chairman of the space committee.

* * *

Electric Features of the World's Largest Ship.—Not the least important feature of the Hamburg-American ship *Imperator*, which has just completed her maiden trip across the Atlantic, is the wireless-telegraph equipment on both the main vessel and the motor-operated lifeboats. The motor-boat equipments have a working range of 200 miles, while the range of the main vessel equipment is 1500 miles. The ship has two reserve antennas and two receiving instruments for long and short waves, designed for news service and rescue work. The station is directed by three operators, one of whom is always at the key. The *Imperator* will be within direct communication with land all through the Atlantic crossing. The other electrical equipment is unusually complete. Energy is developed by five steam turbo-generators and one oil-engine-driven generator placed high above the water line on the boat deck for emergency lighting. The ship is lighted by more than 10,000 electric lamps. Electrical energy is employed for operating the four passenger and five provision elevators, the winches, pivotal cranes, call bells, heating, etc.

* * *

And Now the Motor-Driven Safety Razor.—With motor drive supplanting other forms of power in every field, it is surprising that the safety-razor opportunity has thus far been so neglected. New-business getters interested in developing the early-morning load on their lines will, however, welcome the application proposed in the following letter received by a prominent motor manufacturer from an Arizona "cash clothier": "Dear Sirs:—I am interested in a patent safety razor which is operated by electricity. I have a motor about the size of an apple, attached to the handle of the razor for the purpose of trying the razor out. It works the razor beautifully, but this size motor is entirely too large and bunglesome, besides too expensive. We need motors about the size of a hen's egg, or half that size would be still better. It doesn't require one hundredth part of one horse-power to operate the device. I will explain so as to give you a clearer idea as to what we need. The blade in this razor has the old reaper bar movement; it moves back and forth across the guard; instead of pulling or scraping the beard as other razors do, it cuts across the beard, saw fashion. Now, we simply want enough motor power to make this blade move back and forth across the razor guard. There is no friction to amount to anything, so it requires but very little power. Please let me know the dimensions of the smallest size motor you can make, and give me an idea as to the price in 100 or 1000 lots. Very respectfully, E. B."

* * *

SOCIETY MEETINGS

Society for Promotion of Engineering Education.—At Minneapolis, Minn., June 24 to 26, will be held the twenty-first annual meeting of the Society for the Promotion of Engineering Education. The Hotel Leamington will be headquarters for the association, the sessions of which are to be held at the University of Minnesota and in the West Hotel. A large number of papers and reports on educational subjects have been provided.

* * *

Brooklyn Section, N. E. L. A.—The fifth annual convention of the Brooklyn Company Section, N. E. L. A., will be held at the Oriental Hotel, Manhattan Beach, New York, June 25. The business session will begin at 2:30 p. m. and will be followed by a dinner at which addresses will be delivered by General George H. Harries, president of the Louisville Lighting Company, and Mr. W. F. Wells, vice-president of the Edison Electric Illuminating Company of Brooklyn.

* * *

California Electrical Contractors.—The fourth annual convention of the California State Association of Electrical Contractors will be held at Santa Barbara, Cal., Aug. 13 to 16. The first two days are to be devoted to executive sessions, the third will be an open meeting, and the fourth will be given over to entertainment, ending with a rejuvenation of the Jovian Order. The aims of the society are purely educational, its purpose being to bring about a closer affiliation between contractors, jobbers, manufacturers and central stations. Mr. J. C. Rendler, Los Angeles, is president, and the secretary is Mr. W. S. Hanbridge, 1408 Merchants' National Bank Building, San Francisco, Cal.

* * *

New England Wireless Society.—At a meeting of the New England Wireless Society held at the Massachusetts Institute of Technology on Saturday evening, June 7, Mr. John L. Hogan, Jr., of the National Electric Signaling Company, presented portions of his Institute of Radio Engineers paper on the "Heterodyne Receiving System," which was abstracted in our issue dated June 14. In this reading, which was followed by a long discussion, the use of the "heterodyne" of Professor Fessenden in the Arlington-*Salem* tests was dwelt upon, rather than the theoretical aspects of the device. The newly elected president, Mr. W. E. Duncan, of the Waltham Watch Company, briefly addressed the meeting, which was the last of this season.

Electrical Equipment of Charles River Locks

Extensive electric motor applications at the lower end of Charles River Basin for operating boat locks connecting the basin with Boston Harbor

ONE of the most notable inland waterway improvements completed in the East within recent years is the Charles River Basin at Boston, Mass., extending from tidewater at Boston Harbor to Watertown, 8 miles distant, and formed by the construction of an earth dam 1200 ft. long and about 20.5 ft. in height above mean low water at the foot of Leverett Street. Prior to the construction of the dam the Charles River was a tidewater stream below the Watertown dam, but with the formation of the basin there came into being a lake with constantly freshening waters, the most important portion lying between the cities of Boston and Cambridge and providing an inland watercourse of surpassing beauty. In view of the industrial development at certain portions of the basin and its connecting waterways, it was necessary to provide access for barges and other seagoing vessels of moderate size by the construction of a lock between the basin and the harbor. The operation of the gates of the lock, the movement of filling gates, the movement of sluicegates and capstans, operation of the gates of an auxiliary lock for small boats, raising and lowering of a drawbridge on the dam for surface car and highway traffic, pumping and other auxiliary service are all handled by electric motors supplied in part with central-station energy and in part by energy from the feeder circuits of the Boston Elevated Railway Company. Fifty-two motors, with ratings aggregating 390 hp, are in service, the sizes varying from 150 hp to ¼ hp.

FIG. 1—GENERAL VIEW OF THE LOCK

ARRANGEMENT OF THE LOCKS

The main lock is of reinforced concrete and is 45 ft. wide and 351.5 ft. long, having a depth over the sill of the downstream lock gate of 17 ft. at mean low tide and 21 ft. over the sill of the upstream gate at the normal basin level. The concrete was placed in sections about 40 ft. long with expansion joints between, and for the purpose of carrying telephone and other wires there are embedded in one of these sections sixty 4-in. wrought-iron pipes passing under the lock in long radius bends from five manholes on one side to a corresponding number on the other side. At each end of the lock is a gatehouse containing a recess for the reception of the gate, and the gatehouse at the downstream end is surmounted by a tower with an upper floor 40 ft. above the street level, which is the operating center of the entire installation. The tower is also the center of distribution for the dam and locks, the smaller lock being 56 ft. long, 10 ft. wide and with a depth of 3 ft. below mean low water. The tower also contains an electrically driven air-compressor plant, an Edison service switchboard and wire shaft. The lower gatehouse is also occupied by a public office, machine shop, locker room, lavatory, office of the superintending electrical engineer and quarters of the Metropolitan Park Police. All the central-station service is supplied by the Edison Electric Illuminating Company of Boston with the exception of energy for motor service and lighting at sluice chambers located on the west side of the property, the latter being furnished normally by the Cambridge Electric Light Company. An emergency connection with the Boston Elevated service is also provided on the west side. In general, the 575-volt service of the railway company is used in the operation of the drawbridge, capstans, pumping and in the operation of the main lock gates and the sluicegates of the Boston Marginal Conduit, the latter being available as an auxiliary discharge of the basin into the harbor in addition to its usual functions as the outlet of an extensive municipal drainage system. The remainder of the energy for the motor and general lighting service is obtained from the central-station systems above mentioned.

Each of the main lock gates is a steel structure composed of two main horizontal girders, several main vertical girders and a frame of smaller girders and beams covered with skin plates. The upper part is a double-skin gate and the lower portion has a single skin, except that at the ends plates are carried down on both sides to form a passageway to and from chambers above trucks on which the gate is moved. The lower gate, which is slightly larger to keep out excesssive tides, is about 47 ft. long, 31 ft. high and 6 ft. wide. Each gate is supported on two four-wheeled trucks, about 39 ft. on centers, pin-connected to the frame. The axles are 7.5 in. in diameter, of Tobin bronze, and the boxes, which are 9 in. long, are of cast iron lined with Parsons white brass. The wheels are of cast iron, chilled and ground on tread and flange, and are 30 in. in diameter, weighing 700 lb. each. The wheel treads run on Cambria crane rails weighing 150 lb. per yd. To insure ease of inspection of the trucks and rails, the compartment about each truck has been made tight so that the water can be expelled from it by air under pressure, thus forming a diving bell. Access is then had to it through a small compartment fitted as an air lock, and in making inspections the employee carries a portable telephone by which he is in communication with the force in the upper chamber of the lock gate.

Each of the main lock gates is operated by two motor-

driven endless chains of unusual design, as shown in the accompanying photograph. As stated, each gate moves on a longitudinal axis into a recess in the lock wall, and the recess is housed in a room 77 ft. long and 48 ft. wide, this recess chamber also containing various pumps and remote-control apparatus in addition to the gate-operating motor equipment, air reservoirs and float gages. Two 50-hp, 550-volt Westinghouse crane-type motors are installed at the end of the chamber on concrete foundations, either being capable of operating the gate alone. The motors drive a shaft on the end of which is a spur gear driving an intermediate shaft, which in turn drives a main shaft extending across the rear end of the lock-gate recess. At either end of this shaft is mounted a sprocket, and over each sprocket passes a chain which is connected to an equalizer beam or whiffletree attached to the lock gate. At the opposite side of the lock gate recess, or that end adjacent to the lock, are mounted in suitable bearings two sprockets over which the chains, which are endless, pass. According to the direction of rotation of the motors, the lock gate is thereby moved across the lock or is withdrawn into the gate recess, thus opening it. Each motor is equipped with a solenoid brake overhung on the end of its shaft. The chains are built with triple links of cold-rolled steel having an ultimate strength of about 50 tons per sq. in. The chains are supported on steel tracks to prevent sagging, and the pins are of shafting stock, case-hardened, the wheel bushings being of phosphor bronze. Each chain travels on a track supported on columns resting on shelves on the walls of the gate recess.

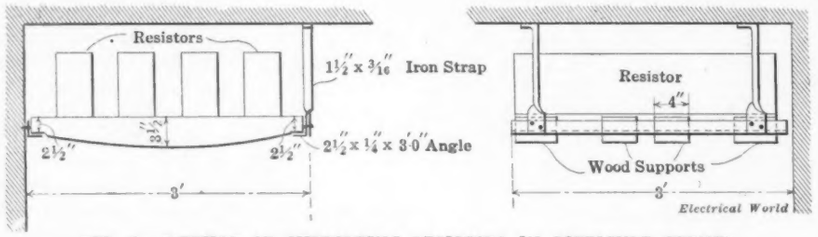


FIG. 2—METHOD OF SUPPORTING RESISTORS IN DIFFICULT CORNER

Each gate is governed by a master controller located in the operating room in the tower of the lower lock gate-house. With this device the operator is enabled to turn on the current by one quick motion of the controller handle. A manual controller is also furnished for each lock gate-house and located in the recess chamber. When the gate is controlled from this point, the master controller in the tower is cut out by a switch located on a marble panel in a remote-control cabinet located near the gate-driving motors in the recess chamber and shown in the accompanying photograph. The manual controller operates the motors in series only and is similar to controllers used in ordinary street-car service. Each lock gate is provided with an automatic limit switch which stops the gate-driving motors shortly before the gate reaches the closed position, and from the last-named point to the closed position it is possible to operate only at the slowest speed. The automatic limit switch also operates to stop the lock gate, through the controlling apparatus, in case the operating switch in the tower is left in the wide-open position on either opening or closing.

The equipment of the remote-control cabinet, with all the other automatic controlling apparatus in the installation, was supplied by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., and was specially designed for this service. The cabinet in the recess chamber at either end of the lock contains a three-panel switchboard carrying knife and contactor switches, relays and solenoid contact switches governing the operation of the lock-gate motors with close accuracy. The equipment includes horizontal switches cutting the master controllers in and out of service for either motor, motor cut-out switches, contactors governing the amount of resistance in each motor circuit, field circuit switches, accelerating relays and series-parallel connecting contactors. Overload and no-voltage release switches and shunt-break switches are also included.

Operation of Locks

A departure from ordinary practice is found in the arrangement for filling the lock. In place of the installation of filling gates in conduits located to bypass the lock, the filling gates are mounted directly on the lock gates themselves. Thirteen gates are used in this service, all being of the non-rising stem type, with operating nuts situated about 20 ft. below the surface of the water. On the lower gate there are six filling gates, 3 ft. 10 in. x 4 ft. in

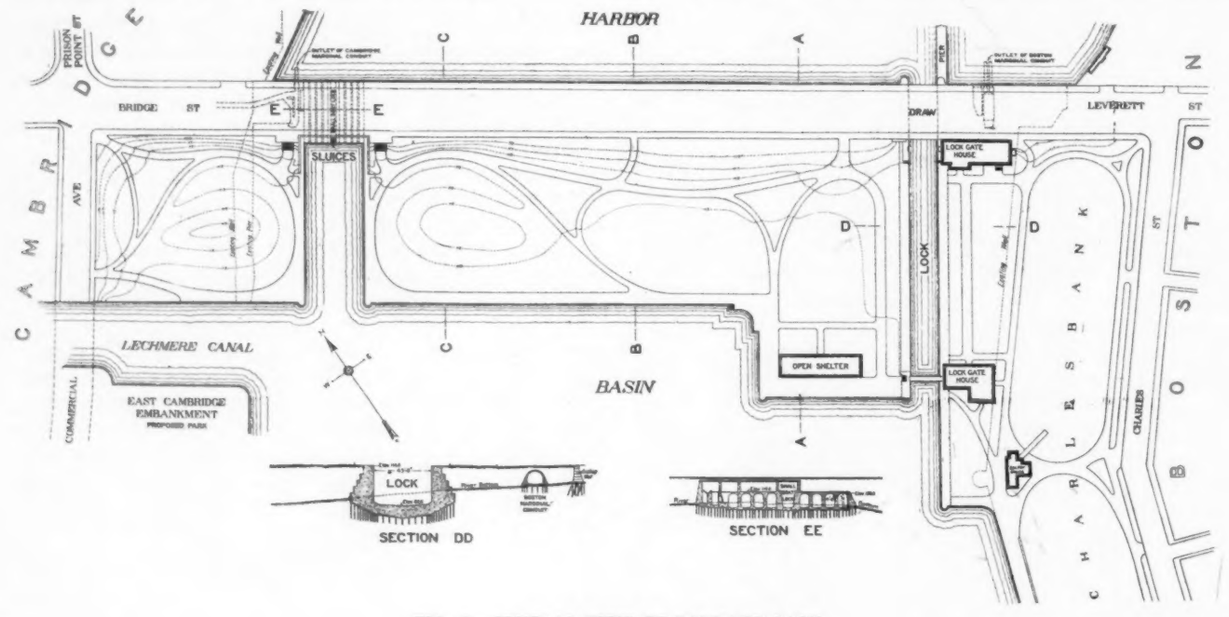


FIG. 3—GENERAL VIEW OF DAM AND LOCK

dimensions, giving a total area of about 92 sq. ft. The upper lock gate is provided with seven filling gates having a combined working area of about 90 sq. ft. These sluicegates are gear driven by 3-hp, 220-volt Northern submerged type motors with ball-bearing operating stands and Cutler-Hammer limit switches. The motors are mounted on the tops of the lock gates and are ordinarily protected by a plank deck. They are controlled from the operating room in the tower and are wound for constant-speed service. The control is such that the sluicegates on each lock gate are thrown in or out to move up or down by a double-throw switch, the group of motors on each gate being connected in parallel. In case any gate becomes bound or stuck in operation it is automatically cut out by a circuit-breaker, the remaining gates continuing to operate without hindrance. Each gate is provided with a limit switch which automatically stops it at the wide-open or fully closed position, and indicator lamps in the tower to be described later show the position of the gates as well as the position of each of the main lock gates during movements.

When these sluicegate motors were first placed in operation it appeared that the motors were working under heavy overloads, and each movement of the filling gates was accompanied by noise and jarring which became excessive on account of the tendency of the lock gates to vibrate. The result was the early loosening of bolts attached to the lock-

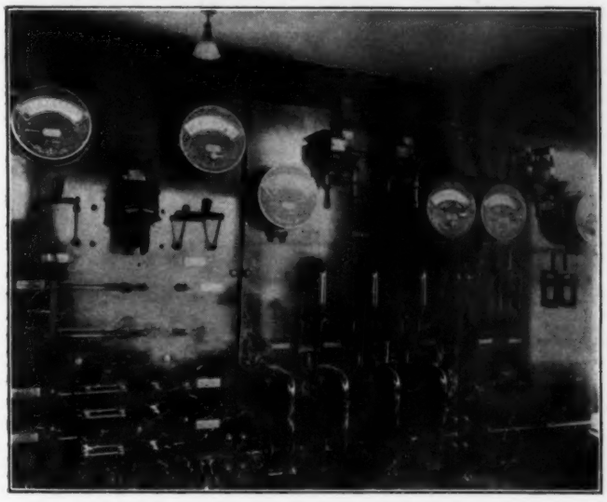


FIG. 4—MAIN SWITCHBOARD IN TOWER OPERATING ROOM

gate structure, and troubles with the motors were also experienced. There had previously been made an attempt to overcome this difficulty by the substitution of cut gears for cast gears, and by increasing the amount of reduction in the gearing; but it was finally concluded that the trouble lay in improper lubrication of the operating nuts on the gates, these being under water and at the time lubricated only by the latter. The lock was pumped out and examination showed that the nuts and operating stems were wearing considerably. Several greases were tried, but none would adhere to the wet shaft. Then a heavy cylinder oil was utilized with temporary success, but the oil soon washed off and the former undesirable conditions returned. The problem was finally solved by the installation of a special grease cup arranged to advance a plunger in the cup at the rate of 1 in. for 144 gate openings, thus feeding a small amount of grease to the stem and nut at each movement. Provision was made for refilling at intervals of one to four months, and tests before and after the application of this device showed that there was a saving of from 15 to 18 per cent in energy consumption through its use. It was also noted that after the grease cup was installed the operation was practically noiseless. A soft grade of Albany grease is used in the lubrication of the stems and nuts.

The supply of energy to the filling gate motors is effected by trolley wires of No. 1 copper supported by suspension ears attached to 0.5-in. by 3-in. iron bars hung from the ceiling by 0.5-in. rods. Each motor has an independent feed and a common return is provided, with connections for various auxiliary services in relation to the limit switches and indicating devices. The trolley stand is car-

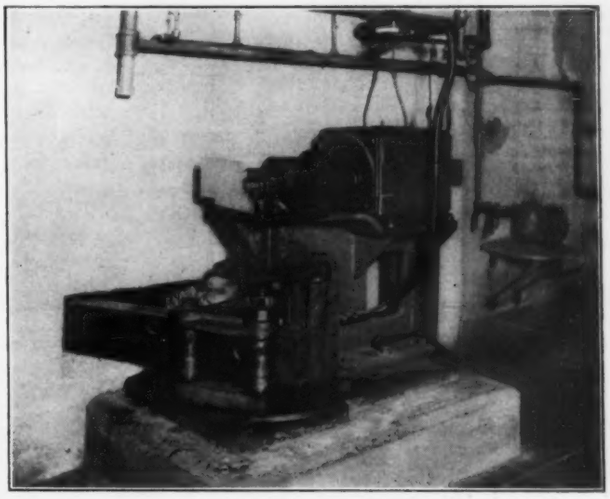


FIG. 5—MOTOR FOR OPERATING SMALL-BOAT LOCK

ried on the cross-bar of the lock gate and is designed to support a double trolley frame.

To enable ice cakes to be passed from the channel above the lock to the harbor, the upper lock gate is provided with an ice-run gate, 2 ft. 10 in. high x 13 ft. in length, placed at about the basin level. This gate is of the double-stem type and is operated by a 3-hp, 220-volt motor supplied with energy through a flexible cable which connects a manual controller on the gate near the trolley stand with an outlet in the wall of the upper gate recess chamber, thus making it impossible to operate the ice-run gate unless the main gate is closed in the lock.

Compressed air is supplied to each lock gate by two West-

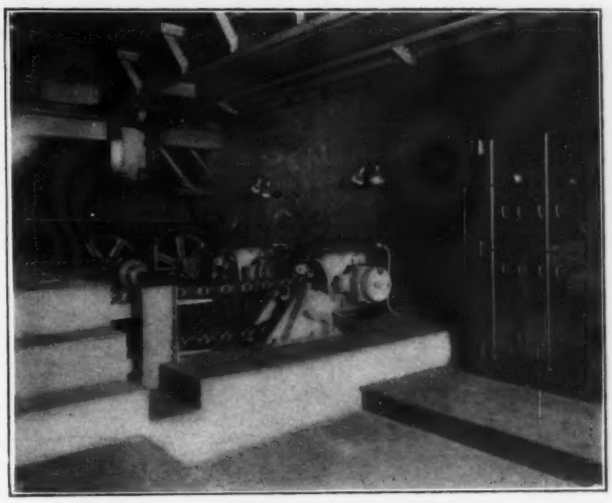


FIG. 6—MOTORS FOR OPERATING MAIN LOCK GATES

inghouse water-cooled, motor-driven compressors equipped with an automatic governor, this service being used in establishing a diving bell at the bottom of the main gates to facilitate inspection of the bearings and for forcing oil at 7 lb. per sq. in. into the bearings for lubricating the wheels upon which the gates are carried. Air is also used in cleaning the remote-control switch cabinets in the recess

chambers, in blowing out machinery and in operating a whistle signal at the tower for the guidance of drawbridge tenders, mariners and others. Each compressor has been designed to deliver 42 cu. ft. of air per minute at a pressure of 90 lb. per sq. in., and each motor is rated at about 12 hp and operates on the 575-volt circuit of the railway company. The air piping on the lock gates is connected to the charging system by hose couplings at each end of the lock gate recess, and in ordinary practice the air is forced into the gate system once a day for a period sufficient to establish the required oil pressure in the bearings. Air can be supplied to the gates only when the latter are fully opened or closed.

A steam-heating plant of two 48-in. horizontal-return tubular boilers designed for 125 lb. per sq. in. working pressure, equipped with a Sturtevant induced-draft fan, is in service for warming the gatehouses and preventing the formation of ice in and around the lock. To prevent the bearing faces on the gates from freezing to the masonry use is made of cast-iron boxes containing pipe coils which warm the bearing faces of the gates through hose connections in the recess chamber. To prevent the formation of ice in the recess in the lock wall into which each gate slides when opened, a pocket was left in the concrete between low and high tide which is covered with a steel plate and gasket containing large steam coil radiators close to the plate. The lock gates are similarly warmed by steam coils placed in the top compartments close to the skin plates. Steam-heating service is also supplied to the small boat lock from the above boiler plant.

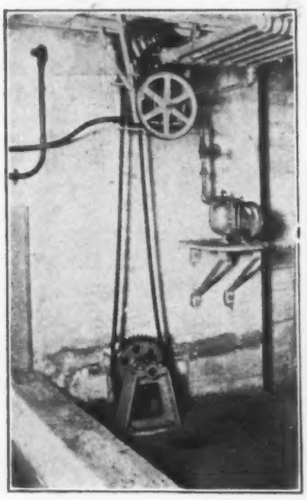


FIG. 7—MOTOR OPERATING SMALL SLUICEGATES

FIG. 8—TOP OF LOWER LOCK GATE AND GATE MOTORS

FIG. 9—SWITCHBOARD FOR EDISON SERVICE

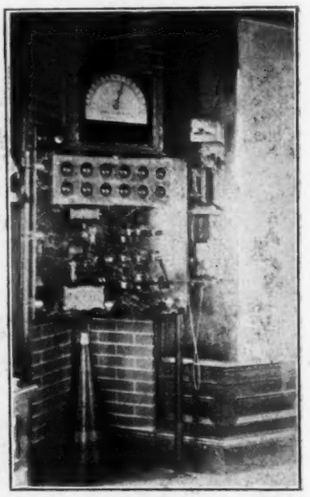


FIG. 10—SWITCHBOARD FOR OPERATING FILLING GATES

Pumping Equipment

For pumping out the lock a 24-in. Worthington vertical volute pump, directly connected to a 150-hp, 575-volt General Electric direct-current variable-speed motor has been installed adjacent to the recess for the lower lock gate and a 14-in. Worthington pump of the same type with a 60-hp motor adjacent to the upper gate recess. The speed range of the larger pump is from 300 to 420 r.p.m., and that of the smaller one from 400 to 500 r.p.m. The larger pump has been designed for delivering 13,000 gal. per minute against a head of 30 ft., the rating of the smaller pump being 5000 gal. per minute against the same head. Each pump is installed in a concrete well. The well of the larger pump is connected with the lock by a 30-in. inlet and with the recess by a 20-in. inlet. That of the smaller pump is connected with the lock by a 16-in. inlet from the lock and with the recess by a 12-in. inlet. Both pumps discharge into the Boston Marginal Conduit, and the lock can be unwatered at an ordinary height in two and one-half hours. Each recess can be unwatered by electric pumping independently of the lock by the use of stop planks. Each pump motor is controlled at an adjacent panel carrying a circuit-breaker, starting switch and speed regulator. In each lock gatehouse a 2-in. centrifugal pump is installed in a sump near the main pump well, each small pump being directly driven by a Westinghouse motor of about 5-hp rating, wound for 220-volt service. The sump in the lower house handles the drainage from the lower pump well and the electric manholes on the premises and that from a wire and pipe conduit situated in the east wall of the lock and connecting the lock gatehouses. The sump in the upper house drains the pump well and also is used in taking care of stop-log leakage in case the recess has been unwatered independently of the lock. These motors are automatically controlled by float switches connected with the sumps.

At the upper gatehouse two inlets are provided between the Charles River Basin and the Boston Marginal Conduit, and normally these are closed. To enable the basin to discharge into the latter, two 7-ft. 3-in. by 8-ft. 6-in. sluicegates have been installed equipped with 5-hp, 575-volt Northern direct-current motors, the motors being geared to the gate spindles and provided with automatic limit switches cutting off current at full closed and full open position, with overload and no-voltage releases. A third 5-hp motor of the same make is installed in a pit outside the building to operate a 6-ft. 4-in. by 6-ft. 6-in. main gate controlling the flow of water in the marginal conduit immediately above the inlets from the basin. The three gates are controlled at a motor-starting panel near the gate-operating mechanism, the panel containing manual controllers, indicating instruments and pilot lamps showing the position of the gate on the marginal conduit at all times.

Two electric dock capstans are installed on the east side of the lock near the gatehouses, each being driven by a 30-hp, 575-volt direct-current motor, through gearing. Provision has also been made for the future installation of motors on capstans on the opposite side of the lock, when necessary. The capstans are available for service in warping vessels through the lock and were installed to cut down to the minimum any delays resulting from opening the adjacent drawbridge during the passage of vessels into the basin. The lock is unique among structures of its kind in the United States on account of the mixture of fresh and salt water obtained in its operation. A stream flow of about 4 miles per hour is established when fresh water from the basin is admitted to the lock with salt water at basin level in the latter, and this is due to the difference in spe-

cific gravity of the waters and at times requires the use of an electric capstan to avoid delays in getting vessels into the basin. The unsettled state resulting from the mixing of fresh and salt waters lasts for fifteen minutes before the current ceases through complete mixing.

CONTROLLING APPARATUS

The operating tower is about 13 ft. square, with bay win-

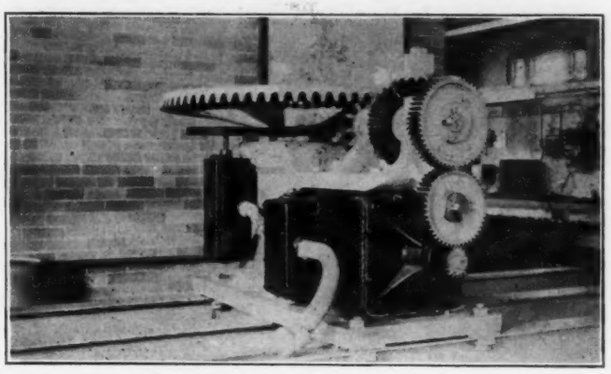


FIG. 11—MOTOR, GEARING AND LIMIT SWITCH FOR OPERATION OF SLUICEGATES

dows in each side of the upper room commanding a complete view of the basin, harbor and lock. In the center of the room is a main switchboard extending around three sides of an 8-ft. by 39-in. rectangle, and in front of the windows are various controllers and indicating devices associated with the operation of the gates and drawbridge. Other switches and indicating devices related to the movement of the lock-filling gates are placed between the windows, together with Winslow electric indicating float gages showing the height of water at all times in the basin, lock and harbor.

The main switchboard contains seven panels of marbleized slate with knife switches controlling the various local feeder circuits, with circuit-breakers, ammeters and voltmeter connections. Among the circuits cut in and out by main knife switches are those feeding the motors on the lock gates, filling gates, capstans, pumps and drawbridge, besides auxiliary circuits supplying energy to incandescent lamps on the premises, semaphore motors and lamps, signal lamps to master and manual lock-gate controllers, and leads to the remote-control contactor switchboards in the lock-

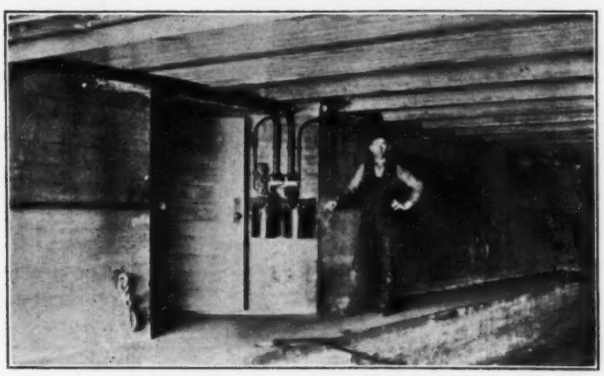


FIG. 12—CONTROLLER FOR OPERATING SMALL-BOAT LOCK

gate houses. The switches are so arranged that the two lock gates cannot be operated simultaneously, and in like manner both manual and master controls of the lock gates cannot be used at the same time. A Duncan watt-hour meter is installed on one panel to measure the lighting energy consumption of the offices and quarters used in the lower gatehouse by the police department of the Metropolitan Park Commission. The energy from the Boston Elevated Railway Company is brought into the building by way of underground conduits, carried through a watt-hour meter in the basement and taken to the main switchboard in lead-covered cables passing up the wire shaft previously mentioned, which is 4 ft. square. The Edison service is likewise brought into the building from underground conduits and carried in lead-covered cables up the wire shaft to a meter installation located in the tower directly under the main operating room, motor and lighting service being subdivided at this point. From the Edison meters the cables lead to the buses on the main switchboard. All fuses on the main board are of the inclosed type and are located at the rear of the panels. The main switchboard contains an emergency switch by which Boston Elevated current can be supplied to the Cambridge end of the dam in case of an interruption.

A lock-gate master controller and an indicating lamp bank are located in front of one of the operating room windows. The lamps are grouped in sets of three 220-volt, 16-cp units in series and show the gate positions in the following steps: "Recessed," "full opening," "3 ft.," "2 ft.," "1 ft." and "closed," each set lighting automatically as the gate reaches the corresponding point. An indicator on a panel controlling the lock-filling gates contains a pair of pilot lamps for each gate which show the position of the

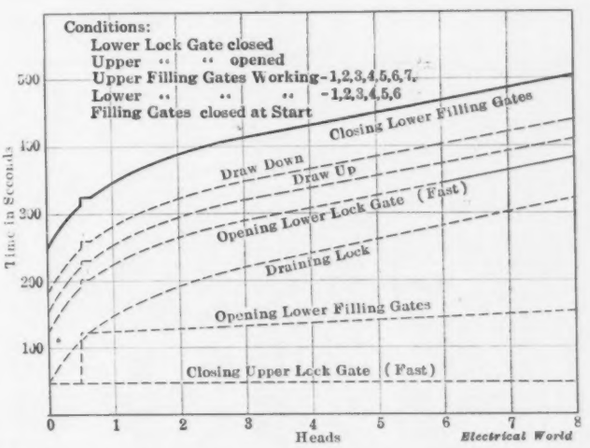


FIG. 13—CURVE SHOWING TIME OF ONE COMPLETE OPERATION

gate at full-open and full-closed points and indicate by the degree of brilliancy the manner in which the motors operate. The lock-filling gates can be opened or closed in less than one minute by a single movement of the switch. The main lock gates can be opened or closed in from forty-five seconds to thirty seconds, depending upon the series or multiple operation of the motors in the recess chambers.

Two drawbridge controllers are provided in front of the window nearest the draw, the bridge being of the two-leaf Scherzer rolling-lift type. Each leaf is operated by a 35-hp, 575-volt General Electric direct-current motor and can be raised or lowered in seventeen seconds. Each motor is provided with a solenoid brake. About 35 amp is required to operate the two motors at once.

The operating room is provided with a private telephone connection with the tower of the Boston Elevated viaduct drawbridge near by, and all important local points about the dam and locks are connected by a Couch interior telephone system. The operating room is equipped with three 1500-watt Simplex electric heaters. The rheostats for the drawbridge motors are mounted on a frame suspended under the tower stairway. The frame consists of four wooden beams 3 ft. long, 4 in. wide and 3.5 in. in maximum depth, carried on 2.5-in. by 0.25-in. steel angles 3 ft. long suspended from the outer ends by 1.5-in. by 3/16-in. straps and spaced one at each end and two in the middle of the

frame. The heaters in the tower are used when the steam boilers are shut down for the summer, and the tower operations are conducted in three eight-hour daily shifts. A small local switchboard panel is provided for the compressors in the tower immediately below the Edison service room. On the main floor of the lock-gate house building is a small machine shop containing a drill press driven by a 0.5-hp, 220-volt motor, a 16-in. lathe driven by a 2-hp motor, a milling machine driven by a 2-hp motor, and an emery grinder driven by a 0.25-hp motor, all directly connected.

To signal vessels about to pass into the lock two General Electric motor-driven semaphores are installed, one near the basin end of the lock and the other on a pier below the Elevated company's viaduct. Each of these semaphores is a two-position signal, with red and green bulls'-eyes and a 12-cp, 110-volt lamp for night service. The semaphore motors are operated by a hand switch in the tower of the lock-gate house and are wired so that only one can be thrown to the clear position at once. The heights of the arms vary from 13 ft. to 25 ft. above the ground, and each semaphore is connected with a signal lamp in the tower which shows the position of the arm at all times.

The small boat lock is equipped with two wooden gates at each end swinging on manganese bronze hinges and

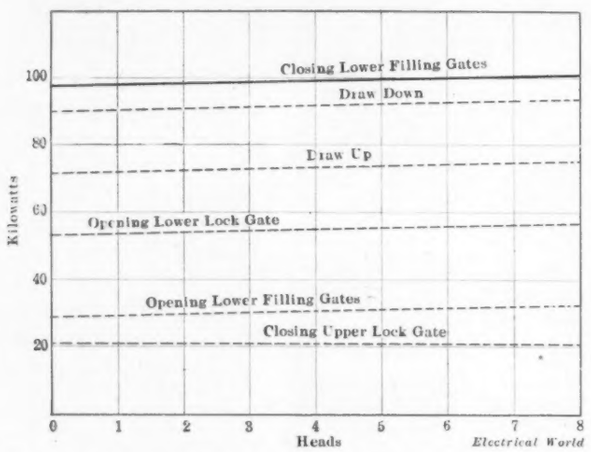


FIG. 14—CURVE SHOWING ENERGY CONSUMPTION FOR ONE COMPLETE OPERATION

operated by four 5-hp, 575-volt General Electric direct-current motors through gearing and a rack-and-pinion drive. The motors are provided with limit switches and no-voltage and overload releases, as in the installation at the main lock, and are operated from manual controllers mounted on the walls of the lock chamber. This lock is filled and emptied by 20-in. by 30-in. sluices at either end by-passing the main gates according to usual locking practice. The sluicegates are opened and closed by 1-hp, 575-volt Crocker-Wheeler direct-current motors through a chain and sprocket drive. The motors are suspended from the ceiling of the sluice chambers under the roadway and are provided with limit switches operating automatically at each end of the gate travel. These filling gates were originally hand-operated, but on account of the slowness of this method the electric drive was installed, with the result that the time of locking a boat through has been reduced from about fifteen minutes to three minutes and only one man is required per shift instead of three. The motors operating the filling gates are controlled by push-buttons mounted on the lock-chamber walls beside the controllers governing the lock gates. A winch was originally provided in one of the walls of the lock for handling the gates, the winch being chain-driven by a 1-hp, 575-volt motor and controlled by a contact lever extending through the lock wall.

Eight 7.5-ft. by 10-ft. sluicegates are installed in the dam, half being on each side of the small-boat lock, for discharging the waters of the basin into the harbor and thereby maintaining the basin level at a desirable elevation. Another sluicegate is installed in a sewer on the Cambridge side of the basin. Each gate is gear-driven by a 5-hp, 575-volt direct-current waterproof motor in a manner similar

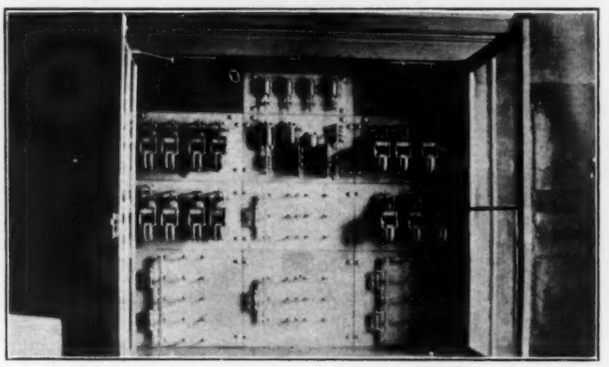


FIG. 15—REMOTE-CONTROL CABINET FOR MAIN LOCK-GATE MOTORS

to that employed in the operation of the sluicegates in the upper lock-gate house. The motors are governed by hand controllers mounted on marbleized slate panels located at two central points in the sluice chambers, and at these panels provision is made for controlling the supply of energy to the circuits of the motors operating the lock filling and emptying gates. An 8-in. centrifugal pump designed to deliver 1200 gal. per minute against a 30-ft. head is installed on the west side of the small boat lock in the sluicegate chamber. This pump is directly driven by a 10-hp, 575-volt General Electric waterproof motor, with a speed variation from 425 to 600 r.p.m., and it is used in unwatering the sluices and the small-boat lock, with final discharge into the harbor.

In the lighting of the various buildings and chambers tungsten lamps of from 15-watt to 60-watt size are liberally used, central-station service being employed for this work. At the upper end of the small-boat lock an electric sign is installed for indicating danger when the sluices are open by the use of five 16-cp lamps in a ruby-glass transparency.

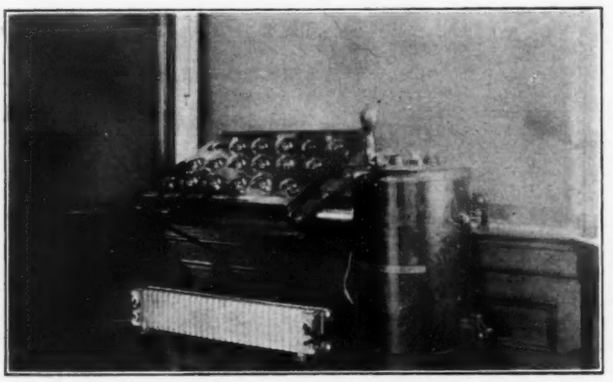


FIG. 16—MASTER CONTROLLER AND INDICATING LAMPS FOR UPPER LOCK GATE

Special precautions have been taken to prevent electrolysis. When the installation was first placed in service it was found that the concrete adjoining the bridge foundations and that next the steel girders carrying the street railway tracks on the bridge structure was damaged by electrolytic action, that next the girders being more or less pulverized. The bridge structure was at first positive to

the water by from 8 volts to 10 volts. The addition of copper to the railway ground return system reduced the potential drop to 3 volts or 4 volts, but as damage still occurred, the railway company installed insulating joints at the ends of the rails, making the water positive to the bridge by from 0.1 volt to 1.5 volts, according to the number of cars on the bridge. At present monthly readings of

FIG. 17—PUMP MOTOR AND ENDLESS CHAINS

potential difference are taken on the bridge, and additional observations are made whenever important changes are introduced in the distribution system of the railway company. To prevent electrolytic action at the axles of the trucks carrying the main lock gates, the former are sheathed with ⅛-in. zinc sheeting held in place by belt lacing. The zinc is renewed every three or four months.

The accompanying diagrams show the power needed and time consumed in performing the single operations required to pass a vessel through the large lock from the basin to the harbor at heads depending upon the difference in elevation between the water in the basin and that in the harbor. Assuming a difference in head of 5 ft., for example, the upper lock gate closes in fifty seconds, the power required being 21 kw. The lower filling gates are then opened in ninety-two seconds with 10-kw input, and 120 seconds are required to drain the lock to the harbor level. The lower lock gate is then opened, requiring sixty-five seconds and 24-kw input. The draw is raised in thirty seconds, taking 18 kw. It is lowered in the same time, with the same input, and the lower filling gates are then closed in sixty-eight seconds, taking 7.5 kw. In normal operation some of these movements are performed simultaneously, so that the average time required to pass a vessel through is about four and one-half minutes.

The force employed for the operation of the locks, bridges and other equipment at the dam consists of thirty-two men. There are three regular operators for the tower service and one spare man, besides a maintainer who serves in the tower in vacation periods. The small-boat lock is closed from Nov. 10 to May 30, and in the last year's operation was opened 2828 times. The large lock was opened 3333 times in the last year's operation, and the drawbridge 2556 times. On week days the drawbridge cannot be opened between 6.15 a.m. and 9.10 a.m. and 4.15 p.m. and 7.40 p.m., on account of the interference with rush-hour traffic on the street-railway system and highway, a restriction which makes a highly desirable off-peak load.

The operation of the entire installation is in charge of Mr. Arthur I. Plaisted, electrical engineer and superintendent, who was in general charge of electrical design and construction for the Charles River Basin Commission during the building of the dam, locks and appurtenances.

Quantitative Results of Recent Radio-Telegraphic Tests Between Arlington, Va., and U. S. S. "Salem"

By JOHN L. HOGAN, JR.

Beginning on Feb. 16, 1913, and extending over a period of nearly two months thereafter, a series of radio communication tests was carried on by the National Electric Signaling Company, between the United States naval radio station[1] at Arlington, Va., and the U. S. S. *Salem*. These trials[2] were for the purpose of determining the reliable communication range of the two stations prior to their being completely taken over by the government. The conditions of the tests were such that the contractors were able to secure much quantitative data bearing upon the design of high-powered radio stations, and it is the purpose of this article to present and interpret that portion of these sets of observations which will prove of general interest and utility.

In addition to study and solution of the numerous problems bearing directly upon the internal plant design, completion of specifications for long-distance radio-telegraph installations involves a number of factors which are dependent mainly upon the degree of communication reliability required and the separation of the stations in question. The most important quantities governed by these conditions may be specified and defined as:

α = absorption coefficient. This is a coefficient occurring in the index of an exponential term which serves to distinguish an expression connecting actual transmitted and received energies from one that defines the energy which would be present at a given point if the only attenuation were that due to distance.

D = distance separating the communicating stations.

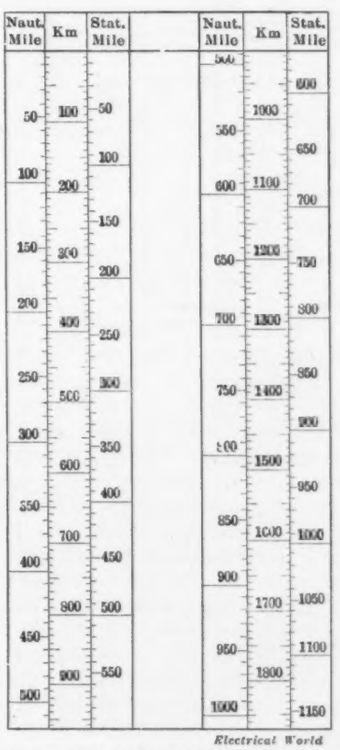


FIG. 1—DISTANCE CONVERSION CHART

λ = wave length upon which communication is effected.

h_1 = effective height of transmitting antenna. The effective height is defined as that from the earth's surface to the center of capacity of the aerial system, and in

[1] In the *Electrical World* for Jan. 18, 1913, Messrs. Tuck and Hodgson gave a partial description of the Arlington station.

[2] The long-distance tests, together with the stations involved, were further described on pages 698 and 721 of the *Electrical World* for April 5, 1913.

the case of a "flat-top" antenna is equal to the geometric height. In an umbrella antenna the effective height is usually taken as the average elevation of the rib-wires of the structure.

h_s = effective height of receiving antenna.

I_s = antenna current at transmitter.

I_r = antenna current at receiver.

d = logarithmic decrement of wave trains per complete period.

N = wave train or group frequency of signals.

S = measurement of received signal intensity (called "shunt") which is the impedance which when connected across the terminals of a telephone receiver reduces the signal intensity to audibility (that is, to a point at which dots and dashes may be just differentiated).

A_f = audibility factor, or the number of times audibility. This is approximately proportional to the square of the radio frequency current in the antenna, and to the current in the telephone circuit. It may be further defined as

$$A_f = \frac{R+S}{S}$$

where R is the impedance of the telephones, to received signals, and S is the shunt as defined above.

as shunt resistance, audibility factor, telephone current and antenna received current) having been determined, it became possible to check the new observations directly against relations developed from the data of the 1910 trials. The measurements upon which the above-quoted relations are based were made in the same way as those of the present test, except that telephones of a lower sensitiveness and tuning inductances of larger high-frequency resistance were used in 1910.

In both tests the Fessenden liquid barretter receiver was used as a standard, but in the 1913 work some of the readings at extreme distance were taken upon the heterodyne receiver. Procedure in this case was exactly the same as with the liquid barretter; that is to say, the audibility factor of the received signals was determined by shunting the telephones. It was found in receiving signals sent out by the spark sets that the heterodyne produced a telephone current variation averaging 4.65 times as large as that due to the liquid barretter alone. This value is the mean of all readings taken during the entire test, but under very favorable conditions the heterodyne's amplifying power on spark signals becomes much greater and the current variation ratio may equal 12 or 15 or even more.

An exact statement of the observations made during the

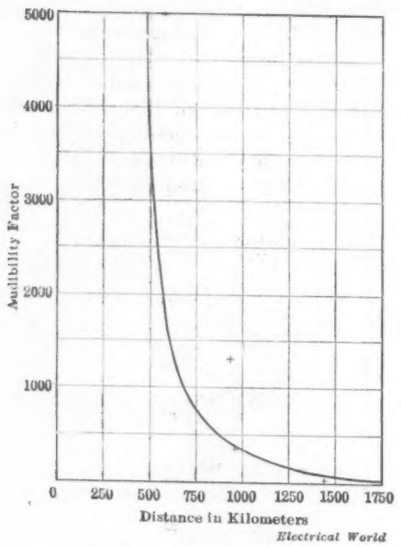


FIG. 2—SIGNALS FROM SALEM BY DAYLIGHT

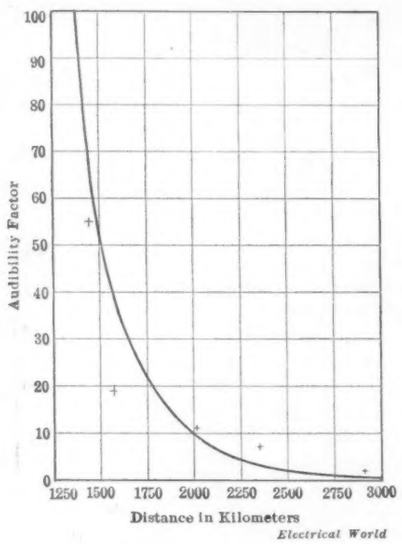


FIG. 3—SIGNALS FROM SALEM BY DAYLIGHT

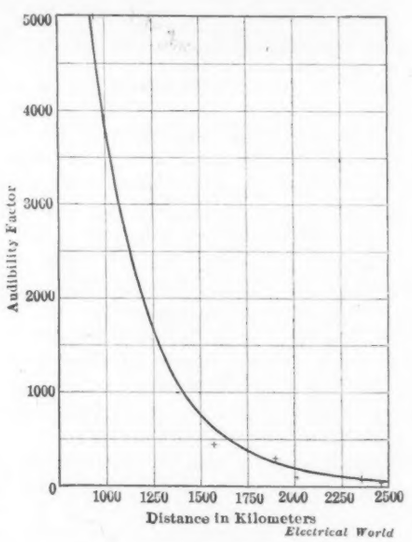


FIG. 4—SIGNALS FROM ARLINGTON BY DAYLIGHT

A series of somewhat similar trials were completed in 1909 and 1910 between the Fessenden high-power radio plant at Brant Rock, Mass., and the U. S. cruisers *Birmingham* and *Salem*, and from the measurements made at that time there has been derived a set of very convenient relations connecting a number of the above-named quantities[a]. The conclusions from the 1910 tests were found applicable to distances up to 1000 miles, with various antenna heights, wave-lengths and sending antenna currents. The present test has given measurements which permit confirmation of the earlier work and which, when taken in connection with data from other experiments, define the relations between some new variables.

Measurements of signal intensity taken during the recent cruise of the *Salem* were made by the shunted telephone method after distances of some 300 miles were covered. With the louder signals received at shorter distances it was possible to secure readings upon a galvanometer placed in the telephone circuit of a firm-contact rectifying detector. The relations between various quantities involved (such recent tests is necessary before conclusions can be drawn and the results compared with the 1910 work. First, taking up transmission from the ship to Arlington, Figs. 2 and 3 show the strengths of signals received at various distances, as measured by their audibility factors. The effective height of the Arlington antenna is 450 ft. and that of the *Salem* 130 ft. The wave-length used was 2000 m, and the average antenna current of the *Salem* in transmitting was 23 amp. All distances are expressed in kilometers, but may be converted into statute or nautical miles by the use of the chart in Fig. 1. The points plotted in Figs. 2 and 3 represent actual observations under normal daylight conditions. The loss of signals at 1900 km may be an instance of very marked selective absorption, but it is believed that an accidental change in circuit constants was responsible, since daylight signals were thereafter received reliably up to 2350 km (at which distance messages were exchanged), and because at the same time very loud signals from Arlington were received aboard the cruiser. The two readings preceding the 2910-km point may be considered as representing a period of high absorption, since no signals whatever were received. The curves shown in these two figures are calculated as described below.

[a] "Some Quantitative Experiments in Long-Distance Radio Telegraphy," by L. W. Austin; *Bulletin* Bureau of Standards, Vol. 7, No. 3, pages 315 to 363.

Measurements of the signals received at Arlington from the *Salem* at night were too uncertain to rely upon, since they were masked by very strong static disturbances which prevented the taking of any accurate readings. At a distance of 1220 km the night intensity was 1300 times audibility, at 1700 km 48 times audibility. An audibility factor of only 3 was measured when the ship was 3140 km away, and

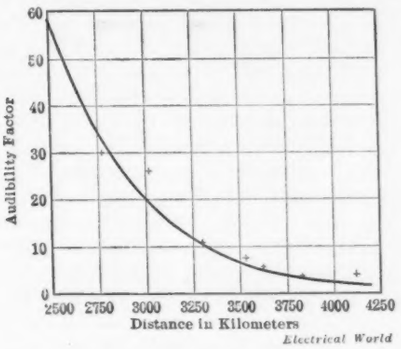


FIG. 5—SIGNALS FROM ARLINGTON BY DAYLIGHT

the same intensity was had over a distance of 3720 km, while on the first of two nights separating these readings signals were ten times audibility and on the second were not heard at all.

In signaling from Arlington to the ship still greater distances were covered, as would be expected. Arlington transmitted on a wave-length of 3800 m, and used an average antenna current of 110 amp while shunt measurements were taken. Figs. 4 and 5 show daylight observations of the signal intensity in terms of audibility factor as measured on the standard detector. At the extreme distances shunts were taken upon the heterodyne signals only, and these measurements divided by the average amplification factor, 4.65, are those shown in the figure. The curve drawn represents the theoretical energy and is seen to be in exceptionally close agreement with the observed values.

The signals transmitted from Arlington at night time were received quite consistently aboard the *Salem* and are shown as the points of the solid curve in Fig. 6. Here the dash line is a smoothed curve giving a general average of the observations, while the dotted curves are calculated for different absorption values, as explained below. It should

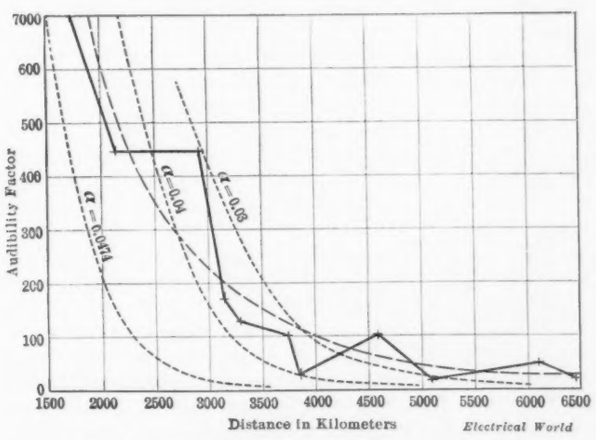


FIG. 6—SIGNALS FROM ARLINGTON AT NIGHT

be noted that on three nights (distances 3750, 4000 and 6220 km) the actual value of received signals was very much higher than the average. When the *Salem* lay at Gibraltar, 6400 km from Arlington, signals from the spark transmitter at Arlington were received nightly and had an intensity of about 200 times audibility on the heterodyne.

The above-stated results may best be interpreted by comparing them with the conclusions previously drawn by Dr. Austin. In his Bureau of Standards paper an expression was given which defines the received antenna current in terms of the distance transmitted, the wave-length used, the heights of sending and receiving antennas and the sending antenna current. The original expression was stated for currents measured in amperes and lengths in kilometers, but it has been found that for convenience in computation it is best to have each term in the units normally used in recording it. I am therefore giving the expression with its coefficients modified so that h_1 and h_2 may be measured in feet, the distance in kilometers, the received current in microamperes, the sending current in amperes, and the wave-length in meters.

$$I_r = \frac{3.92\, I_s\, h_1\, h_2}{\lambda\, D\, \varepsilon^{\frac{0.0474\, D}{\sqrt{\lambda}}}} \qquad (1)$$

With the apparatus used in 1910, Dr. Austin found that a received antenna current of 10 microamp through a resistance of 25 ohms (or a power 2.5×10^{-9} watts) gave a just audible signal. In connection with his publication of results he selected 40×10^{-9} watts, which gives a signal of sixteen times audibility on the above basis as that which limited good working distance between the two stations. In the present tests, with inductances of better design and more sensitive telephones, the signal produced from

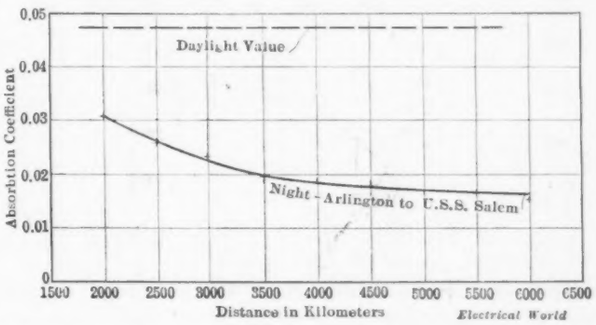


FIG. 7—NIGHT ABSORPTION AS A FUNCTION OF THE DISTANCE

a given received antenna current was louder than before, but it is probable that the over-all equivalent resistance of the receiving antenna circuit was about the same, since selectivity of the same degree was obtained with closer couplings, which fed energy to the detector at a higher rate. It has been found with this new apparatus that an audibility factor of unity is had for an antenna current of about 5 microamp, or for received energy about one-fourth of that assumed by Dr. Austin. If this relation between audibility factor and antenna current is substituted into equation (1) above the expression[4] becomes

$$A_f = \left(\frac{156.8\, I_s\, h_1\, h_2}{\lambda\, D\, \varepsilon^{\frac{0.0474\, D}{\sqrt{\lambda}}}} \right)^2 \qquad (2)$$

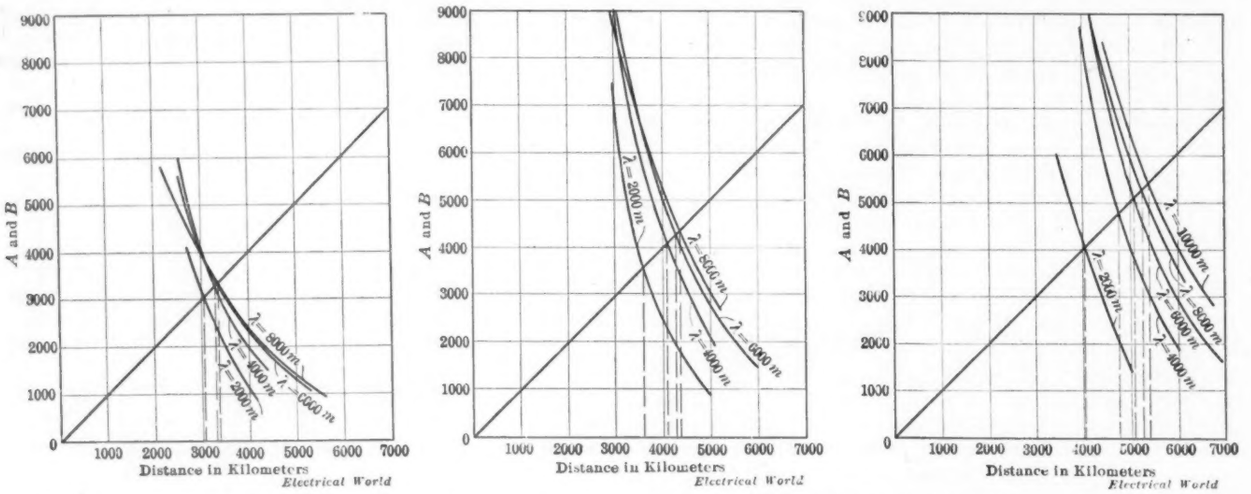
The curves plotted in Figs. 2, 3, 4 and 5 are calculated from equation (2) and show the strength of received signal which would be expected for the conditions defined by the various constants stated. The agreement between actually observed values and the curves is exceptional and affords an excellent confirmation of the relation between the constants of equation (1) as determined by Drs. Austin and Cohen. In this study of the present test their results are applied for the first time to a consistent series of measurements taken between ship and shore over gradually increasing distances up to 4000 km.

It should be noted that in order to secure agreement between the observations and the theoretical expression it is

[4]This expression should not be used for computing the signaling distances of normal radio-telegraph apparatus, since its constants apply only to specially designed instruments of high efficiency.

necessary to change the value of the received current for a just audible signal, from 10 to 5 microamp. Other alterations in the original formula might be suggested, but it is believed that in changing the numerical relation of received current to audibility factor the proper modification has been made. To take up each of the other factors in turn, it is manifest that the value of I_s cannot be modified, since this expresses the transmitting antenna current as measured by a standard ammeter. The distance and the wave-length are equally well defined, and so there are left susceptible of alteration only the absorption coefficient and the effective antenna heights. By definition the effective height of the *Salem's* flat-topped antenna is fixed at 130 ft., since the downward leading-in wires are of negligible capacity. At Arlington the center of capacity is about 450 ft. above the ground, and if the effective height as used in equation (2) were made greater than this by an amount large enough to compensate for the increase in signals as compared to those to be expected upon the 10-microamp basis, it would become larger than the height of the tallest tower supporting the antenna (600 ft.), so that manifestly alteration of the equation cannot be made by a change of this value. The almost perfect agreement between observed signal beginning of the test and equaled 0.0391 as determined by equation (3). It is seen that even this value is considerably less than the normal daylight attenuation coefficient.

In Fig. 6 the three dotted curves are calculated from equation (2) for absorptions of 0.0474 (the normal daylight value), 0.04 and 0.03 respectively. It is seen that the dashed curve showing average observed values crosses the last two of the dotted curves, and from this it appears that transmission at night does not follow the same law of absorption as that in daytime. The probability of this is further increased by a consideration of Fig. 7, which shows the effective absorption as a function of distance when successive values of the dashed curve in Fig. 6 are substituted in equation 3. If the law governing attenuation were the same for night as for day, the graph of Fig. 7 should be a horizontal straight line, although its constant value would probably be something less than 0.0474. It should be possible to determine the law of night variation by analyzing the data of Fig. 7 and substituting it in equation (2). Inasmuch as the measurements were taken on only one wave-length, however, the result would be of little value on account of its incompleteness. But it is hoped that the data will be of use in connection with future observations which may make it



FIGS. 8, 9 AND 10—DAYLIGHT SIGNALING DISTANCE BETWEEN TWO STATIONS OF THE ARLINGTON TYPE FOR AUDIBILITY FACTORS OF 500, 100 AND 25; WITH $I_s = 100$ AMP, AND $h_1 = h_2 = 450$ FT.

intensities and those calculated on the basis of a 5-microamp audibility limit at the long distances (when the absorption effect is a maximum) on wave-lengths of both 2000 m and 3800 m indicates not only that the value of absorption coefficient ($\alpha = 0.0474$) is very nearly accurate but that the functional relation is correct as well.

If equation (2) is solved explicitly for the absorption coefficient, the following relation is obtained:

$$\alpha = \frac{\sqrt{\lambda}}{D} \log_\epsilon \frac{78.4\, I_s\, h_1\, h_2}{\sqrt{A_f}\ \lambda D} \qquad (3)$$

A further check on the form of the expression and the value of the coefficients may be made by determining the daylight absorption for each distance at which signals were observed. A set of these calculations shows an average absorption on the 2000-m wave of 0.0407 and on the 3800-m wave of 0.0560, giving a general average for all daylight readings of the test as 0.0483, which is in very good agreement with the value, 0.0474, given by Drs. Austin and Cohen.

The night observations shown in Fig. 6 are of interest in that from them may be obtained a notion of the minimum absorptions encountered during the test and also of the difference between the laws governing night and day transmission of signals. For the night trials the lowest effective absorption occurred at 6220 km, where its value was only 0.012. The greatest night absorption was present at the possible to define this relation, which is at present very uncertain.

The approximate uniformity of the signals from Arlington at night indicates a nearly complete absence of reflection effects during the test on a wave-length of 3800 m. The great irregulatities noted on the 2000 m wave transmitted from the *Salem* prevent use of those observations as a basis for calculations, and may be due not only to the static interference mentioned but also to transient reflections.

It has been seen that when the liquid barretter is used in connection with the modern receiving equipment the received signal has unit audibility factor for an antenna current of 5 microamp. A study of the receiving antenna current necessity to give various signal intensities, together with a knowledge of the possibility of reading signals of these various intensities through the different static and other disturbances which are encountered, will make possible deductions as to feasible working distances under various conditions. Practice has shown that with light static and interference messages can be read when transmitted from a spark apparatus using 1000 wave-trains per second, even though the received signal be only twenty-five times audibility (corresponding to a shunt of 200 ohms across Western Electric 2400-ohm telephones). Isolated groups of signals can be distinguished even though the audibility factor be considerably less than 25, but the transmission of messages

will be unreliable unless there is a complete absence of interference or atmospheric. If the received signal has an audibility factor of 100 (corresponding to a 50-ohm shunt), a good interchange of messages is possible; but for commercial telegraphing at high speeds of hand signaling and at an intensity which will permit copying received messages directly upon a typewriter, an audibility factor of about 500 is necessary. Upon a basis of 5 microamp for unit audibility the receiving antenna currents corresponding to the three intensities just stated are 50, 100, and 225 microamp.

In the test just completed, which was the first in which the heterodyne was used over long distances between ship and shore, it was found that a heterodyne amplification of 4.65 in audibility factor might be relied upon. The ratio of the signal intensity with the heterodyne to that without (using the same telephones) was considerably greater than the average when the received signals were weak, so that it is evident that with this instrument unit audibility may be had for something less than 2.5 microamp, when a persistent spark transmitter of the Arlington type is used. For the various degrees of communication ability described, the following currents would then hold: For reading messages, 12.5 microamp; for good intercommunication, 25 microamp; for commercial telegraphing, 56 microamp.

These current values are especially low when compared with those which would give equivalent signals upon any type of receiver other than the Fessenden heterodyne. Actually, they are quite conservatively stated, since they are based upon an amplification of less than 5, whereas the actual ratio may be three or four times that figure. The actual intensities of signals at which messages were copied during the test is not shown in Figs. 3 and 5, inasmuch as the heterodyne was used both at Arlington and aboard the *Salem* for the longer distances, and the points plotted are for liquid barretter operating normally. By multiplying the ordinates of these curves by the amplification ratio of a little less than 5, it is possible to learn the approximate signal strengths which occurred at the various distances.

The value of the heterodyne in its power to increase the effective signaling ability between a given pair of installations may be determined by comparing the distances over which it is possible to transmit messages consistently with it and with the regular receiver. Working from the ship to Arlington, the final official distance for transmitting complete messages was 1610 km (1000 statute miles), at which point the signals had an audibility factor of 88. Without the heterodyne this signal intensity would have been encountered at only 1400 km (870 statute miles). Signaling in the reverse direction, messages were read at 3830 km (2383 statute miles) on an audibility factor of 26 (the amplification ratio being something better than the average at this extreme distance). If the regular barretter receiver alone had been used, this limiting intensity would have been reached at 2900 km (1800 statute miles). It is obvious that except for very severe static disturbances the *Salem* could have transmitted more than 1000 miles to Arlington, but inasmuch as this distance was that fixed by the Navy Department for the limiting official test, no attempt was made to establish official communication under the same conditions at greater distances. In considering the increase of received signal by application of the heterodyne system, it must be recognized that this device does not operate in any sense as a telephone relay. Its fundamental principle of operation is that two high-frequency alternating currents of slightly different periods can mutually interact to produce an indication at an audible frequency but greater in amplitude than could be produced by the weaker of the two currents alone. For best effect there is required a high degree of persistence in both of the interacting oscillations, so that obviously highly damped discharges, such as those due to atmospheric excitation of the receiving antenna, are subject to much more feeble amplification than are persistent oscillations from a well-designed radio transmitter. The ideal condition for use of a heterodyne receiver requires continuous generation of oscillations at the transmitting station, and in receiving from a high-frequency alternator or arc sender the heterodyne responds to antenna currents still smaller than those quoted.

The establishing of relatively small received antenna currents for good audible response makes possible some valuable extensions of the data obtained. In considering the distance over which it would be possible to signal between two stations of the type installed at Arlington the very interesting effect upon signal intensity caused by changing the transmitting wave-length may be noted.

Dr. Austin's paper gives a tabulation of the sending antenna current which would be necessary in order to permit a signal of sixteen times audibility to be received at various distances upon several wave-lengths. The received current assumed, 40 microamp, is enough to give a very loud signal when the heterodyne is used, but on the basis of the old assumption (10 microamp for unit audibility) the received energy could hardly be considered enough to permit reliable reading of messages. A part of the tabulation mentioned is reproduced.

SENDING ANTENNA CURRENT IN AMPERES

Distance in Nautical Miles	2,500 M	3,750 M	6,000 M
1,000	13.5	15	17
1,500	49	44	46
2,000	155	122	105
2,500	470	314	235
3,000	...	775	500

Examination of this table shows a number of interesting points, such as the inadvisability of using very long waves for short or moderate distances, and these may be investigated further by putting equation (2) into such form that it may be solved for distance in terms of its other factors. Since D is expressed both as a co-efficient and an exponent, there is no explicit solution, and graphics must be relied upon.

If the equation is expressed as

$$D - \frac{392\, I_s h_1 h_2}{\lambda D\, \epsilon^{\frac{0.0474\, D}{\sqrt{\lambda}}}} = 0, \qquad (4)$$

it is a simple matter to secure solutions for distance in terms of wave-length or other quantities by considering the equation to have the form

$$A - B = 0, \qquad (5)$$

where

$$A = D \qquad (6)$$

$$B = \frac{392\, I_s h_1 h_2}{\lambda D\, \epsilon^{\frac{0.0474\, D}{\sqrt{\lambda}}}} \qquad (7)$$

It is evident that in solving this equation the various values may be substituted into the right-hand member of equation (7), and that A and B values may be drawn independently as ordinates on the same sheet with D as abscissas. At the point of intersection of the A and B curves, which of course indicates equality of A and B, the condition of equation (4) above holds, and the distance desired for assumed values of the other quantities may be read directly from the abscissa below the intersection.

If there are assumed conditions for two stations of the Arlington type, with effective heights equaling 450 ft. and sending antenna current 110 amp (which is not the maximum antenna current for the Arlington plant but a conservative value), by the use of equation (4) it is possible to calculate the distances at which a certain antenna current will be received on a number of different wave-lengths.

Figs. 8, 9 and 10 are drawn from computations made in

this way and show strikingly the advantage of long waves for signaling over great distances. Fig. 8 shows the distances at which a very strong signal (500 times audibility) will be received on wave-lengths of 2000, 4000, 6000 and 8000 m. It is interesting to note that at these distances there is no advantage in using wave-lengths much longer than 6000 m. Fig. 9 shows the same points for a weaker signal (audibility factor equals 100), but one which is easily read except under the very worst conditions. The computations plotted in Fig. 10 are for the weakest signal upon which messages are clearly readable through light static or interference.

Before complete investigation can be made of the best wave-lengths, the effects of changes of group frequency and of wave decrement, etc., it will be necessary to secure and study more experimental data than are given herein. It is hoped that quantitative results of other transmissions over long distances will be forthcoming from time to time, and that by careful consideration of them it will be possible to fix beyond any doubt the actual numerical relations between all important quantities involved in the design of high-powered radio-telegraph stations.

Watt-Hour Meter Error Due to Earth's Field

During tests made on a 15-amp watt-hour meter to determine the effect of the earth's field on its registration at light loads, Mr. C. B. Stelle, in charge of the meter department for the Springfield (Ohio) Light, Heat & Power Company, found discrepancies amounting to 1.25 per cent between 180 deg. positions, at 50-watt loads. The meter examined was of the General Electric C 15-amp type. Varying differences were discovered, depending on whether the meter was turned east or west, north or south, the maximum variation being observed, of course, between the latter positions. Mr. Stelle conducted the test to obtain evidence against the practice of bringing customer's meters into the shop for routine tests. To correct for the various stray fields likely to be present where the instrument is installed, each meter should be tested under the conditions of its every-day use.

Damage Done by Cable Puncture in Kansas City

Men engaged in work involving the tearing up of city streets should know, of course, the exact location of underground pipes, conduits and wires belonging to public-utility companies. Failure to possess this knowledge, or perhaps carelessness in execution, led to the accident illustrated herewith. Fig. 2 is a section of a three-conductor cable belonging to the Metropolitan Street Railway Company of Kansas City, Mo. This cable was punctured by a drill believed to have been operated by a man employed by the gas company in searching for a leak in one of the mains

Several cables carrying about 1500 kw each are installed in tile ducts and tie the 6600-volt buses of the main generating station and one of the substations together. Each conductor in the cable is about No. 000 stranded, and while the drill did not absolutely sever any conductor, one phase

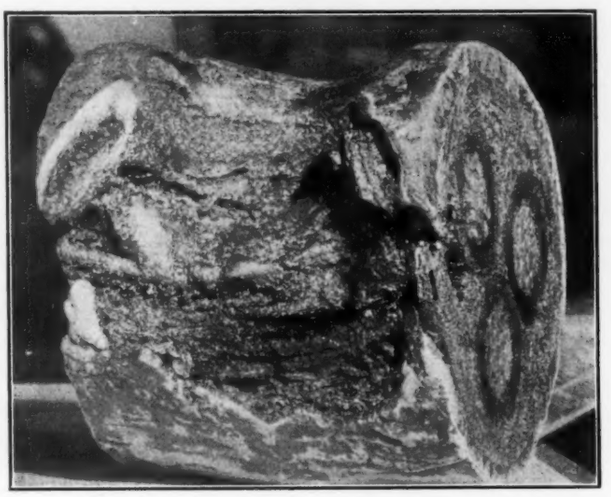


FIG. 2—SECTION OF INJURED THREE-CONDUCTOR CABLE

lead was evidently short-circuited to the lead sheath. The static interrupters gave an indication of the ground early on the morning when the cable is supposed to have been damaged. On account of the heavy load which the station was carrying at the time it was not considered advisable to cut out the cable, as it was hoped that the ground would not cause a permanent failure.

Previous to this a slight but not serious ground on another cable had been traced to a point in the gallery of the generating station. About twelve hours after the ground had been noticed on the cable in the street, the grounded phase evidently burned through the insulation to the other conductors and caused a terrific surge of current, which threw out the oil switches over the entire system. When this happened the cable in the gallery failed, evidently because of the increased voltage to ground, blowing out the walls of an air chamber, destroying series transformers, a 300-amp knife switch and other apparatus. A turbo-generator ruptured one terminal lead and disabled a switch.

For eight minutes the entire city was without electricity, as the lighting company and the railway company are served from high-tension buses operated in parallel. During this time the ruptured cables were located and removed.

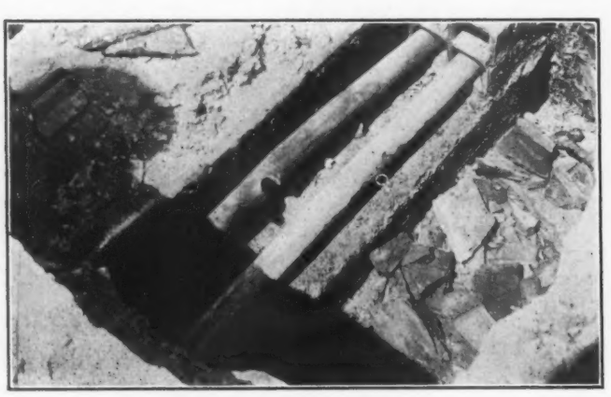


FIG. 1—CABLE EXPOSED FOR INSPECTION

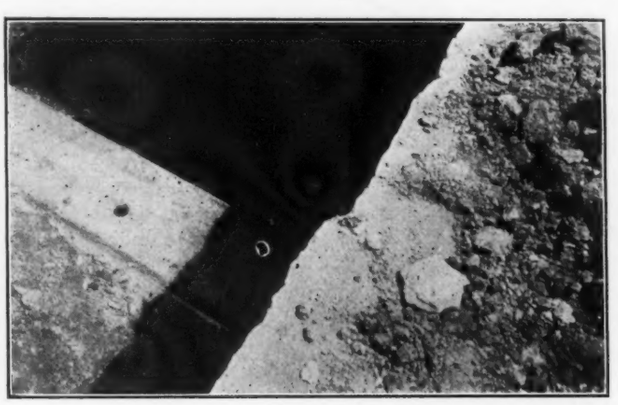


FIG. 3—POINT AT WHICH DRILL ENTERED CONDUIT

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Summer Electric Service for Office Building

During the months from May to October the private plant supplying heating service and alternating-current energy to the new Railway Exchange Building, St. Louis, the largest office building in the world, will be shut down completely, and electricity to operate lamps and motors will be taken from the central-station system of the Laclede Gas Light Company, of St. Louis. The load transferred in this way will aggregate about 1500 kw.

A Ten-Thousand-Dollar Slogan Sign for Toledo

Through the Toledo Commercial Club the Toledo Railway & Light Company plans to present the city with a huge slogan sign costing at least $10,000, the company to maintain and operate the display. Its publicity department is now conducting a slogan contest under the Commercial Club's auspices. Over 4000 suggestions for the best civic motto have already been received.

Operation of similar slogan signs in other cities has resulted in an improved public attitude toward the company, besides stirring up interest among national advertisers and local users of electric signs.

"If It Isn't Electric, It Isn't Modern"

Several months ago the Dayton Power & Light Company adopted as a slogan the phrase, "If it isn't electric, it isn't modern." So thoroughly has this terse truth since been fixed upon the minds of the local public that the other day when a landlord advertised a dwelling for rent he took pains to add, with a praiseworthy regard for truth, "Modern, except electric light."

Later, with the owner's permission, Mr. T. F. Kelly, contract agent for the Dayton company, reprinted the advertisement in the company's display space, following it with the comment: "Landlords realize it is much easier to rent their houses when they are wired for electric light. Why not have your house wired at once? 'If it isn't electric, it isn't modern.'"

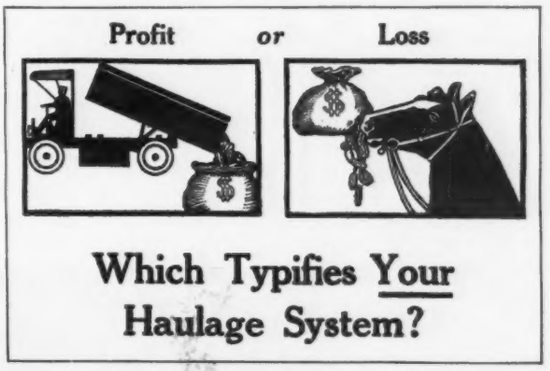
Company's Duty to Maintain Service Once Started

Action was recently brought by Celia Hollander against the Westchester Lighting Company for cutting off the gas supply to her premises, after refusing to receive her tender of the full amount of her indebtedness. A demurrer was filed by the defendants on the ground that the complaint failed to specify the amount tendered, and also failed to allege that the plaintiff's premises were within 100 ft. of the gas main. In overruling the demurrer, Judge Tompkins at a Special Term of the Supreme Court in Westchester County laid stress on the three points which here follow:

(1) Where a lighting corporation cuts off the existing supply to a customer, the burden is on the corporation to justify its act by showing an indebtedness which the customer has refused to pay or some other good and legal reason. (2) In an action to recover damages for discontinuance of an existing supply of gas, it is presumed, in the absence of a contrary showing, that the premises are within 100 ft. of the gas main. (3) Although there is a provision in the transportation corporations law whereby a gas company need not furnish service outside that 100-ft. limit, when the service has once been installed it cannot be cut off on account of the position of the premises the presumption being that the company has waived that provision by furnishing the gas.

Effective Electric-Vehicle Advertising at Boston

The accompanying illustration taken from one of a series of advertisements now being run in the Boston press under the auspices of the Electric Motor Car Club of Boston provides an effective contrast between the efficiency of the electric vehicle and that of the horse-drawn wagon and emphasizes the rapid increase in fleet equipment of many prominent users since the earlier campaigns of the organization in the newspapers. The advertisement contrasts the slow speed, limited mileage, susceptibility to heat, cold and sickness, heavy feed and stabling expense and high cost of depreciation on the part of the horse with the capacity of the electric truck for heavy duty, its low maintenance cost, "fuel" economy, freedom from repairs, simplicity of control and efficiency independent of weather conditions.



ADVERTISEMENT FROM BOSTON NEWSPAPER

Thirteen large New England firms are now using fleets aggregating 209 electric vehicles, among these being the Edison Electric Illuminating Company of Boston, fifty-four machines; American Express Company, thirty-four; General Electric Company, twenty-five; Ward Baking Company, twenty-four; National Express Company, twelve, and various central stations of smaller size, coal companies, department stores and lumber concerns. Five makers of electric passenger cars, four manufacturers of electric commercial cars and four accessory manufacturers participated in the latest weekly display advertising of the club, which is being extended to arouse a wider interest on the part of business men and persons interested in shorter-distance service in the results now being achieved by the electric machine in the New England field. Everything points to a constant growth in this interest.

Use of Storage-Battery Trucks and Cranes in Brooklyn

The storage-battery electric truck and crane has proved a saver of time, labor and expense in handling merchandise from all parts of the world at the piers and in the yards of the Bush Terminal Company in Brooklyn, N. Y. Briefly described, the apparatus is a flat car with a swinging crane

FIG. 1—HOISTING WITH ELECTRIC CRANE

operated by a 1-ton electric hoist at the forward end, while a storage battery supplies energy both for driving the vehicle and operating the hoist. Not only is the crane capable of hoisting material and depositing it wherever desired, but it is constructed to serve as a locomotive to haul flat cars as well. For simple hoisting the machine is brought into position, the brakes are set, and the vehicle remains stationary as the boom of the crane moves back and forth between the picking up and depositing points. By this method 300 castings, aggregating 65,000 lb., were unloaded from a gondola car in five hours; a box car was loaded with sixty-four 800-lb. barrels of plumbago in twenty-five minutes, and four cars were loaded in two and one-half hours, the latter work including "spotting" the cars.

When material has to be moved less than 400 ft., or in small quantities, the articles are lifted by the crane, conveyed to their destination by the vehicle and placed where

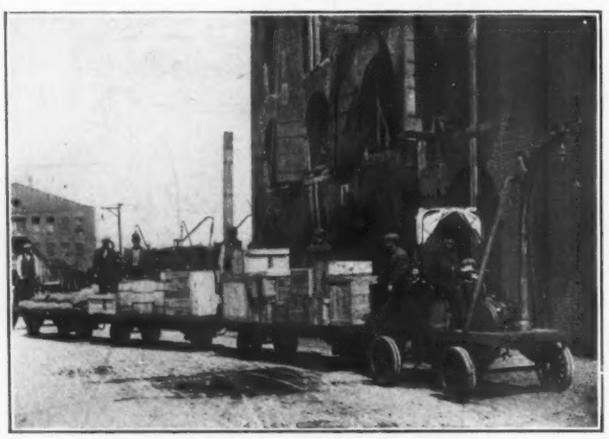


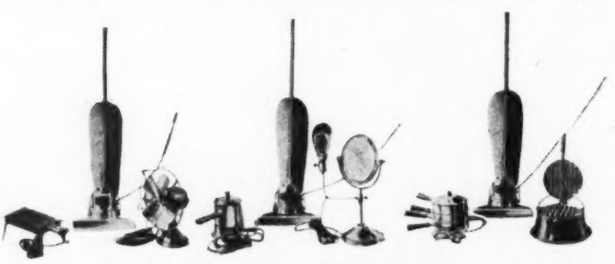
FIG. 2—BATTERY TRUCK USED AS LOCOMOTIVE

desired. By this pick-up-and-run method, sixty 800-lb. barrels of plumbago were moved 300 ft. in one hour, one helper only being required, and 150 300-lb. boxes of rubber were conveyed 75 ft. and loaded into a box car in fifty minutes. For shipping large quantities of freight over considerable distances the electric truck is used as a locomotive, drawing a train of flat cars on which it has placed its own load. The cost of operating one of these electric-battery trucks at the plant of the Bush Terminal Company is about $24 a week, including operator, interest, depreciation and electricity. It is figured that the cost of moving 1 ton (nine packages) 900 ft. is only 3 cents. The electric service at the Bush Terminal is purchased from the Edison Electric Illuminating Company of Brooklyn.

A Thirty-Nine-Dollar Group Appliance Sale at Denver

During a recent thirty-day period the Denver Gas & Electric Company instituted a "group" sale of appliances by means of which the housewife could purchase any one of twelve groups of devices at a net price of $39. The price of the three articles in each of the various groups totaled about $50, but the company mailed to its customers engraved coupons good for $11 applying on the purchase price for a limited period. The balance might then be paid $3 down and $3 a month, at the customer's discretion. In this way the transaction would be completed within a year.

Following were the groupings from which customers were invited to make their selections: (1) Ohio vacuum cleaner, electric iron, American toaster; (2) Ohio vacuum cleaner, American curling iron, "El Perco"; (3) Ohio vacuum cleaner, G. E. grill, "El Toastovo"; (4) Ohio vacuum cleaner, American "Perco," American curling iron; (5) Ohio vacuum cleaner, "El Chafo," "El Toastovo"; (6)



THREE TYPICAL APPLIANCE GROUPS IN DENVER CAMPAIGN

Ohio vacuum cleaner, American heating pad, American disk stove; (7) Ohio vacuum cleaner, Westinghouse 8-in. fan, "El Toastovo"; (8) Ohio vacuum cleaner, L. L. shaving mirror, American cup; (9) Ohio vacuum cleaner, American combination set, gas waffle iron; (10) Ohio vacuum cleaner, laundry stove, American electric heater; (11) Ohio vacuum cleaner, Reznor gas heater, L. L. water heater; (12) Ohio vacuum cleaner, Vulcan water heater, American disk stove.

Electric Garage Equipment and Management

An interesting paper entitled "Electric Garage Equipment and Management," by Mr. H. M. Martin, of the H. C. & A. I. Piercy Contracting Company, was presented at a meeting of the Electric Vehicle Association of America in New York recently. The author remarked that, although the design of an ideal electric garage would seem to be an easy matter, yet considerable attention must be paid to its details. There are many points of difference to be considered between a garage for electric vehicles and one for gasoline automobiles. For instance, an electric vehicle cannot be successfully housed in a building which is kept at a temperature of less than 60 deg. Fahr., but the temperature is of much less importance where only gasoline machines are to be housed. Among the other points which the author considers of importance in the design are location, elevator service if the building is to have more than one floor, placement of posts, floor surfaces, lighting, charging equipment, ventilation, heating and machine-shop facilities.

The management of an ideal garage should be vested in a single head, a person of business ability and a technical knowledge of the industry. If for some reason there must be a choice between a good business man and the technical man, then it is the opinion of Mr. Martin that the business man should be chosen as the head and the technical man should be his trusted subordinate. The question of making repairs and minor adjustments for the garage customers gratis was thought to be largely a point for the judgment of the garage manager to determine, as it is a hard matter to draw a definite line of distinction between the repairs which ought to be charged and those which should be free to the customer.

The paper was discussed briefly by Messrs. C. D. Marsh, S. G. Thompson, S. C. Harris, R. M. Lloyd, E. C. Roberts, P. Lindeman, A. D. Stevenson, E. W. Gough, F. B. Neely and F. F. Sampson. Acting Chairman C. D. Marsh stated that the association membership is now larger than ever before, twenty-five members having recently been added.

Analysis of Motor-Service and Heating Costs in a Jewelry Factory

The jewelry factory of the Codding-Heilborn Company, North Attleboro, Mass., is now operated by central-station energy from the local electric plant, the contract of the jewelry manufacturer having been obtained by Mr. William Plattner, local electrical manager, after a detailed engineering investigation of the former isolated-plant conditions. The test of commercial service has thoroughly justified the change to central-station drive, the customer reporting entire satisfaction with the motor equipment installed.

The factory was formerly operated by a 50-hp slide-valve engine supplied with steam from a 90-hp horizontal return-tubular boiler. No traps were used in the steam piping which supplied various parts of the factory with heat. Considerable annoyance was experienced from time to time at the slowing down of the rolling mill, polishing apparatus and steam-driven blower equipment, production being sensibly diminished under mechanical driving. The introduction of electric motors, however, speeded up the polishing tools enough to give about 13 per cent greater production, besides resulting in a better quality of work. All motors are of the

TABLE I.—MOTOR EQUIPMENT FOR JEWELRY FACTORY

Service.	Motor Hp.	R.p.m.
First floor:		
Scratch-brushing and coloring, including two direct-current plating dynamos, three scratch-brushing heads and one 13-in. exhaust fan	3	1200
Polishing bench, No. 4 blower, six heads	7.5	1200
Duplex power pump in engine room	2	1200
Three rolling mills	7.5	1200
Two high-speed drills, three lathes	0.5	1800
Tub-cleaning machine	0.25	1200
Emery wheel, double 10-in. diameter	1	1800
Two drop hammers, 450-lb. and 300-lb.; two 200-lb. and two 75-lb. drop hammers, one power press and one rotary shear	5	1200
Second floor:		
Machine shop, including two engine lathes, one shaper, one emery wheel, one cut-off saw, one grindstone, one milling machine	2	1800
Four power presses, six high-speed lathes	2	1800
Third floor:		
No. 3 American gas-furnace blower	2	1800

220-volt, three-phase 60-cycle induction type. The motor equipment installed is shown in Table I.

The total connected load of motors is 32.75 hp, representing an investment of $668.

In this, as in many other cases where isolated plants are to be converted, the question of heating was an important factor, and on account of its interest to the motor-service solicitor, it is analyzed somewhat in detail in Table II.

The heating hours totaled 2779 per year, divided as follows: January, 419; February, 378; March, 334; April, 279; May, 170; June, July and August, 0; September, 170; October, 287; November, 323; December, 419.

Under the conditions prevailing, the condensing factor of

TABLE II.—LAY-OUT OF HEATING SYSTEM

	FEET OF WROUGHT-IRON PIPE.		
	1-in.	1¼-in.	2½-in.
First floor:			
Coloring room	....	160	...
Main shop	....	310	...
One sixty-coil radiator	150	....	...
Packing room	329	....	...
One twenty-coil radiator in office	50	....	...
One five-coil radiator in office	12	....	...
Second floor:			
Machine shop, etc	....	552	...
Returns	....	....	172
One sixty-coil radiator	150	....	...
Four-coil pipe in sample room	328	....	...
Returns	150	....	...
Third floor:			
Header coils	254	....	127
Total linear feet of pipe	1423	1022	299
Equivalent square-feet radiation	492	443	221
Total radiation surface, 1156 sq. ft.			

radiation was taken as 0.35; that is, 0.35 lb. of steam per hour for every 100 sq. ft. of radiation, giving a total of about 385 lb. of steam condensed per hour, or 1,069,915 lb. of steam condensed per year. From examination of the plant it appeared that an evaporation of 8 lb. of water per pound of coal was required, giving approximately 59 long tons (2240 lb. per ton) for the heating season of nine months, the steam pressure not exceeding 15 lb. per square inch.

Steam Required for Commercial Service

The coloring room was equipped with nine electroplating vats, each of 4 gal. capacity, in a long wooden tank, supplied from five ⅜-in. pipes, the valves being open sufficiently to heat the water continuously throughout the day. There was also one large sink receptacle, heated at four-hour intervals daily and run fifteen minutes at a time, it being connected with a ½-in. steam pipe. A steam blower above the acid-cleaning vats served for removing fumes, although used intermittently. A sawdust box, 8 ft. by 2½ ft. by 12 in. deep, was also connected directly to the steam supply pipe. The survey indicated the desirability of connecting the steam return of this sawdust box into the electroplating tank, so that the surplus steam could be utilized.

The main shop had a pickling vat connected with a ⅜-in. steam pipe, steam being required to keep the solution warm during the day. There was also a sawdust box, 5 ft. by 2½ ft. by 12 in., and three other receptacles connected to a ⅜-in. steam pipe and used intermittently. The analysis of working conditions indicated the importance of connecting the drying-box return pipe in series with the pickling vat, and supplying steam through the box into the vat, instead of returning the steam to traps in the engine room.

The second floor contained a pickling vat connected with a ⅜-in. steam pipe, and sawdust boxes, 4 ft. 6 in. by 2 ft. by 12 in., with ½-in. steam supply. As in the case of the first floor, a series connection of the drying-box return pipe with the vat was here recommended, instead of the independent return to the engine room.

It was assumed that in the coloring room the variable opening of the five valves sufficiently to keep the water hot was equivalent to the continuous opening of one ⅜-in. valve. The outflow of steam at a pressure of 15 lb. per square inch is 17.6 lb. per minute per square inch of orifice. A ⅜-in. pipe has an orifice area of 0.110 sq. in., so that the discharge is 0.110×17.6, or 1.93 lb. per minute, or 1158 lb.

of steam per ten-hour day. This gives a yearly output of 347,000 lb., figuring 300 days of operation.

Similarly, one large vat heated every four hours from a ½-in. pipe for an average of fifteen minutes at a time requires 6192 lb. per year. The steam blower over the acid cleaning vats, used five minutes at a time every fifteen minutes throughout the day of ten hours, requires a yearly input of 206,400 lb., based upon the above constant output of 17.6 lb. per minute per square inch of orifice at 15 lb. per square inch. The requirements of the entire plant were then summarized as follows, after determinations were completed for the rest of the equipment along the lines indicated: Coloring room, 347,400 lb.; vat in sink, 6192 lb.; steam acid blower, 206,400 lb.; pickling vat, first floor, 86,850 lb.; vats in sinks, first floor, 86,850 lb.; sinks, second floor, 86,850 lb.; total, 820,542 lb. for commercial service. On the basis of an evaporation of 8 lb. of water per pound of coal, there would be required for this work a yearly fuel consumption of 102,567 lb. of coal, or 46 tons of 2240 lb. each.

Cost of Electricity

The estimated cost of electric energy for this factory was $66 per month, based upon a ten-hour day and service used 300 days per year. The average monthly consumption of energy determined was 2200 kw-hr., the average rate being 3 cents per kw-hr. The point was made that central-station service would be available at all times, and that a licensed engineer or fireman would not be needed so long as the steam pressure was kept below 15 lb. per square inch, since steam was not to be used for developing mechanical power. It was necessary, however, to equip the boiler with a sealed safety valve set at 15 lb. per square inch and approved by the State inspector of boilers.

The total cost of equipping the factory for electric driving was estimated as follows: Motors, complete, with bases, pulleys, labor, freight, $668; wiring, fittings, switches and erection, $160; pulleys, belting, shafting hangers, erected, $80; drying boxes connected to vats, piping and labor, $12; total, $920.

The estimated yearly cost of operation, excluding fixed charges, was $1,444.50, the items being as follows: Electrical energy, $792; coal for heating, 59 tons at $4.50, $265.50; coal for commercial uses, sinks, etc., $207; attendance, one-quarter of the time of one man at $60 per month, inspecting motors, firing boiler, etc., $180; total $1,444.50.

New Rates at Marquette Municipal Plant

The Light and Power Commission of Marquette, Mich., recently established a reduced schedule of rates for service from the municipal hydroelectric plant. The new rates for residence and commercial lighting are as follows: First 200 kw-hr. per month, 5 cents per kw-hr.; next 100 kw-hr. per month, 4 cents; next 100 kw-hr. per month, 3 cents; over 400 kw-hr. per month, 2 cents.

The new motor-service rates placed in force at the same time were: First 200 kw-hr. per month, 3 cents per kw-hr.; next 200 kw-hr. per month, 2 cents; over 400 kw-hr. per month, 1 cent.

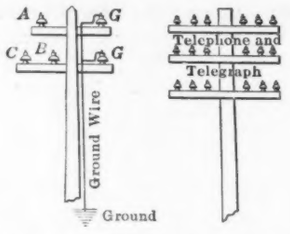
The former rates were 6 cents per kw-hr. for residence lighting and 5 cents for commercial lighting, reaching 3 cents to 2 cents per kw-hr. for long hours of use and for large installations. The old motor-service rate ranged from 5 cents to 0.75 cent per kw-hr., depending upon the amount of use.

The rate for street arc lamps is $60 per year for all-night service. The commission has had a reduction of this rate under consideration, but reports no conclusion in the matter. There has been some public agitation in Marquette for a single flat rate per kw-hr. for all classes of consumers regardless of conditions of use, but the commission does not regard this as practicable under present conditions.

Illumination and Wiring

Ground-Wire Shields to Prevent Induction Trouble

The accompanying sketch shows the transmission-line construction adopted at the request of the owners of the telegraph and telephone lines, closely paralleling which a right-of-way had been secured for the 23,000-volt, 60-cycle circuit. The power-line delta was accordingly carried on



SHIELDING TELEGRAPH LINES AGAINST INDUCTION TROUBLES

the far side of the pole, the short-arm extensions on the telegraph side being used to support a couple of ground wires, one above the other, and each earthed securely at every seventh pole. Considerable fear had originally been expressed concerning induction troubles on account of the close proximity of the high-tension line, but after several years' operation no complaint has yet been made.

"Cost Systems in Electrical Contracting"

"Cost Systems in Electrical Contracting" was the title of a paper, prepared by Mr. Leo Dalkart, Moline, Ill., which was read by Mr. J. H. Warder before a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers in Chicago recently. The author remarked that heretofore very few tabulated data have been compiled on the overhead charges connected with electrical contracting. The cost of the material and labor can be quite easily estimated on the unit basis, but charges which do not come under these heads have previously been levied on each job without much regard as to the proportion which each should share. Fixed charges on conducting a business should be levied on the various contract estimates according to the locality, the weather and the conditions under which the particular work is executed. The apportioning of overhead charges on different estimates should bear a certain relation to the time which is required to execute a contract.

Instead of levying a certain percentage charge on the total estimate to allow for overhead expenses, it would be better to proportion the charge on material and labor separately. The items of the overhead charges that depend directly on the material which is used should be summarized for previous years and a certain percentage assessed on the different materials during the following years. By a similar summary of overhead charges which can be traced to labor a certain charge per man-hour can be assessed on labor. Taxes, advertising and bad accounts can be divided pro rata between material and labor.

The author of the paper suggests that the overhead charges be plotted from month to month so that the need of a revision in the system of apportioning charges can be made at once and a policy for the ensuing year adopted. Several curves accompanying the paper showed the variation in freight charges, office supplies and vehicle charges during the different months of the year.

Among those who took part in the discussion of the paper were Messrs. R. H. Rice, J. H. Warder, A. S. Pardee, J. A. Wickum, S. Montgomery, C. D. Wesselhoeft, E. H. Free-

man and C. A. Kellar. Mr. Rice said that he did not believe in the unreliability of estimates. Too many overlook the overhead charge or try to trim it down so that the estimate will correspond more nearly with final results which are obtained on completion of the job. A total estimate should not be more accurate than that on any one of its parts.

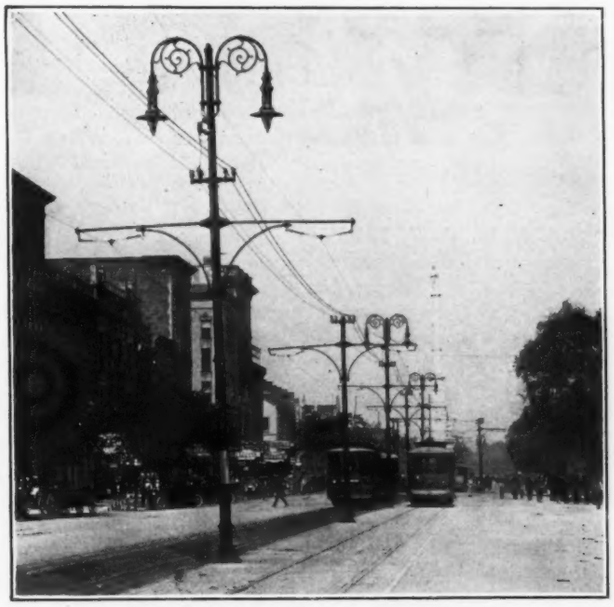
Mr. Wickum considers the cost system recommended by the National Electrical Contractors' Association as the best. It is an expensive system, however, and should be figured in as an overhead charge which has to be proportioned among the contracts.

Mr. Keller suggested keeping a weekly account of overhead charges. Estimates on units or previous jobs should be kept and a monthly statement of each individual job recorded. Cost books, records of sub-contractors' contracts and changes in contracts should be kept on file. This material, together with the information possessed by timekeepers, material men and estimators, should assist in obtaining a systematized cost system.

Mr. Montgomery said that all expenses not included under labor and material should not be classed as overhead. Incidentals should be charged against particular jobs.

Flame-Arc Street Lighting at Augusta, Ga.

The main thoroughfare of Augusta, Ga., is known as Broad Street and its width does not belie its name, for it is 180 ft. from building line to building line. Flaming-arc lamps of the Adams-Bagnall type are used to light the business section of the street, and these are suspended in pairs 28 ft. from the roadway on extensions to the trolley poles, which are spaced 150 ft. apart along the center of the street. The lamps are rated at 7 amp and cost the city $60 each per annum. Energy is supplied from the circuits of the Augusta-Aiken Railway & Electric Company. Needless to state the substitution of the flaming-arc lamps for the older inclosed-arc lamps made quite a difference in the illumination of the thoroughfare, which owing to its width is difficult to light with any degree of satisfaction from the center of the roadway. Although the greatest intensity of light does not fall on the sidewalks, the lighting company has quite a sign and window lighting load in the district mentioned, so that that section of Augusta is one of the brightest spots in the South. The lamps, of which there are forty-four installed, are trimmed every fifth day.



FLAME-ARC LIGHTING UNITS ON BROAD STREET, AUGUSTA, GA.

The Ontario Wiring Code

The Hydro-Electric Power Commission of Ontario has just issued its new book of rules and regulations for inside electrical construction, including rules on signaling systems, wireless-telegraph apparatus, electric-railway work, etc. Some time ago a preliminary copy of these rules was issued which met with considerable opposition. As a result the present rules are framed according to somewhat different standards and now correspond very closely in the main to the National Code. The commission's rules, however, are declared to be a distinct advance at certain points over the National Code rules. The Ontario rules, for example, cover thoroughly the question of life hazards, not included in the National Code. The arrangement under the different headings is also improved. The wiring requirements in connection with switches and cut-outs are all compiled under one heading. Contents are indexed, making it easy to find any particular item. The Ontario rules also contain a certain amount of detail not found in the National Code. They specify all materials, fittings, devices, etc., which have been formally approved, without question, by the commission. The commission, however, does not tie itself rigidly to the Underwriters' Laboratories approval, but will permit the use of any material where it is demonstrated to the satisfaction of the commission that this material is up to the standard set by the Chicago Laboratories. Another provision is for the appointment of municipal inspectors to enforce due observance of the regulations. Wherever possible, these inspectors will have no other duties, combining rather the work for several municipalities in order to occupy their time fully. There is also outlined a system by which the inspectors' work will be standardized throughout the Province.

Recent Telephone Patents

Improved Switchboard Apparatus

Most switchboard frameworks are to-day of steel construction, the woodwork being used merely to fill the spaces and to give a finished appearance. The apparatus is carried by the steel work and must be designed accordingly. In the past it has been the custom to drill the key-shelf frame for individual screws for each key mounting. Mr. E. B. Craft has sought to improve upon this arrangement by slotting the frames longitudinally and by providing the key bases with a stud at each end which will project into the slots. The keys are clamped by a screw and washer entering the stud from beneath, the washer resting upon the bottom of the steel work out of contact with the stud. The patent for this arangement has been assigned to the Western Electric Company.

Mr. P. C. Burns, of Chicago, has received a patent for a telephone switchboard employing a combined jack and drop. The jack and the drop are combined as a unit for sliding into guides. The contacts of each unit engage with contacts at the rear of the switchboard. The units are held in place by pins which are inserted from the top, each pin locking an entire vertical row of units. The pins serve as night-bell contacts.

Subscriber Station Appliances

Mr. M. M. Reynolds, of New York City, has obtained two patents for receiver supporting arms. In each the chief novelty lies in the means for assuring the proper operation of the hook switch. In the first a helical groove causes the receiver to stand out of position, holding the hook depressed. When the head of the user is before the transmitter the receiver is revolved so that the hook rises. If the receiver is relieved of pressure it returns to the right, forcing the hook down. A latch is provided for holding the line, but in the locked position a plate closes the transmitter so that the receiver must be unlocked before conversation may

begin. In the second device a similar action is provided by slightly different means.

A type of supporting arm has been patented by Mr. W. C. Ude, of West Haven, Conn. The hook switch is omitted. The receiver arm actuates the moving springs when thrown into the proper relative position, a small hand-operated latch serving to maintain the circuit when the line is to be held. Release of the latch is effected when the ear is pressed against the receiver.

Letters to the Editor

Meters on Two-Phase Circuits

To the Editors of the Electrical World:

Sirs:—The second article on "Lamp Operation Due to Accidental Ground," which appeared in your issue of May 24, page 1098, while continuing the discussion from the standpoint of distribution, now opens up the question of metering. It would be interesting to know how the combined lighting and motor service, which is advocated as the best that can be used, would be metered. (See Fig. 2, page 1098.)

The entire installation can be completely metered by meters on the primary side—either one polyphase meter or two single-phase meters. If, however, the installation must be metered on the secondary side, and separately for motors and lamps, using (as is ordinarily done) a single-phase meter for the lamps and a polyphase meter for the motor circuit, then this scheme of wiring has certain very objectionable characteristics from the standpoint of unmetered current.

An inspection of Fig. 1 herewith indicates that the scheme of wiring as ordinarily metered would expose not merely an unmetered source of single-phase energy, as most combined systems are liable to do, but three unmetered sources of single-phase, differing from each other in phase or potential, and serving as a source of unmetered polyphase energy.

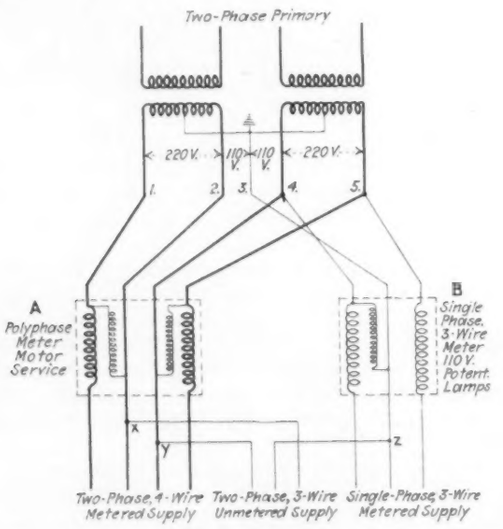


FIG. 1—DIAGRAM SHOWING TWO-PHASE, THREE-WIRE UNMETERED SUPPLY

The point *Z* in Fig. 1 need not be taken on the house wiring of the lighting meter, but may be any ground and produce the same results.

The three-wire lighting circuit could also be connected to wires 2, 3 and 4, if it was desirable to load partially each of the two service transformers. The lighting would then be polyphase, however, and would have to be metered with a polyphase meter. The conditions of unmetered supply would remain substantially the same.

It is possible to meter completely such a system of wiring on the secondary side, but this arrangement of meters has certain disadvantages and is not advocated as ideal. (Fig. 2.) For the four-wire, two-phase motor-circuit supply it is necessary to insert a current coil of a meter in each of

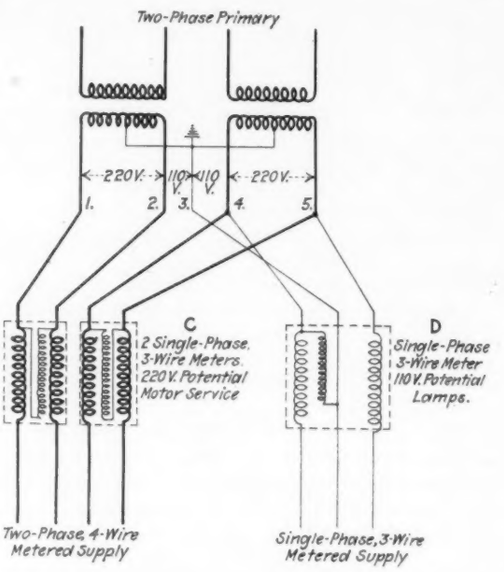


FIG. 2—ARRANGEMENT AVOIDING UNMETERED SUPPLY

the four wires. This can be done by two single-phase, three-wire meters with 220-volt potential coils. This arrangement is more expensive than polyphase metering and is not specially desirable from the registration and billing standpoints.

The strongest argument for this system of distribution would appear to be the uniform and minimum potential to ground measurable from all of the secondary wires. The system, however, should not be advocated as the best for general use except after a careful consideration of the metering requirements.

New York, N. Y. Frank V. Magalhaes.

Seamless Splicing Sleeve

To the Editors of the Electrical World:

Sirs:—With reference to the article entitled "Splicing Sleeve," on page 1276 of your issue dated June 7, attention should be called to the fact that the oval type of seamless splicing sleeve there described was first developed by Mr. Walter G. Clark. Mr. Clark experimented for a year or more, some seven or eight years ago, with this type of sleeve. He found that the question of annealing was of the utmost importance. A sleeve of this type if too hard will crack open on being twisted, and if too soft it simply will stretch open and give a joint of no particular strength. He finally developed a process of annealing—one which has been modified only slightly since—that insures an absolutely uniform product and makes it possible at the present time to supply a sleeve of this type which is guaranteed to be stronger than the incased conductor.

Sleeves of this type were recently purchased by the Isthmian Canal Commission for use on United States government transmission lines in the Panama Canal Zone, where atmospheric conditions are about as bad as they may well be owing to the heat and moist air.

E. G. Hatch,
Manager the Clark Electric & Manufacturing Company.

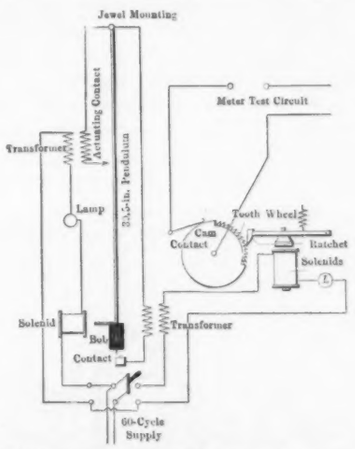
New York, N. Y.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Pendulum Counting Device for Testing Meters

For testing rotating-standard meters Mr. C. B. Stelle of the Springfield (Ohio) Light, Heat & Power Company, makes use of an improved pendulum counting device which considerably simplifies the process. Its application depends upon the fact that if T be taken as thirty-six seconds, the



ONE-SECOND PENDULUM AND COUNTER CAM FOR CONNECTING METER TO CIRCUIT

familiar meter expression $\frac{3600 \times K \times R}{T}$ becomes simply the product of the constant times the revolutions multiplied by 100, a result easily computed. The device shown in the sketch comprises a one-second pendulum and counter cam which automatically connects the meter in circuit for thirty-six-second test periods, thus fulfilling the above condition.

This apparatus avoids the use of a stop watch, with its accompanying human factor, and requires only one man to make the test. It also tests the rotating standard from start to stop each time, duplicating the conditions of the test meter's practical use. The Springfield company employs two rotating standards, one of which is calibrated every three days. No attempt is made to adjust the standard, but a calibration curve of its errors at varying loads is prepared.

The 39.5-in. pendulum shown consists of a wooden rod boiled in paraffine and carrying solder-filled bobs, the whole being hung from a four-jewel meter bearing. The slight impulse needed to keep the pendulum in continued motion is supplied by the solenoid winding at the left of the bob. A contact pin on the pendulum swings through a globule of mercury, actuating the counter solenoid. To avoid destructive sparking at the contacts, which was at first experienced, these contacts simply close secondary windings of potential transformers whose primaries are in series with the solenoids and resistor lamps. As long as the secondaries are open the current passing through the solenoid is small, but when short-circuited enough current flows to operate the mechanism.

For the cam wheel a couple of meter disks were used, one having been filed with sixty teeth and the other having its periphery cut away for an arc equal to thirty-six of the teeth. The wheel is thus rotated through the interval of one tooth every second, completing a full rotation in one minute. For thirty-six seconds of this period the contact brush bearing on the cam surface closes the meter circuit, breaking it again automatically at the end of that period. By means of the double-throw switch at the bottom the counting device may be disconnected while the pendulum continues in operation. This feature is useful while warming up a meter preparatory to making the test. In the right-hand position both pendulum and counter are actuated.

The mechanism at Springfield was built almost entirely of old meter and arc-lamp parts, and despite its home-made character, has proved extremely useful in carrying on tests.

Substituting Reactors for Auto-Transformer Starters

After constructing a home-made reactor in its own shops and finding it very satisfactory when used for starting synchronous machines, the Kansas City Electric Light Company, of Kansas City, Mo., has decided to make more

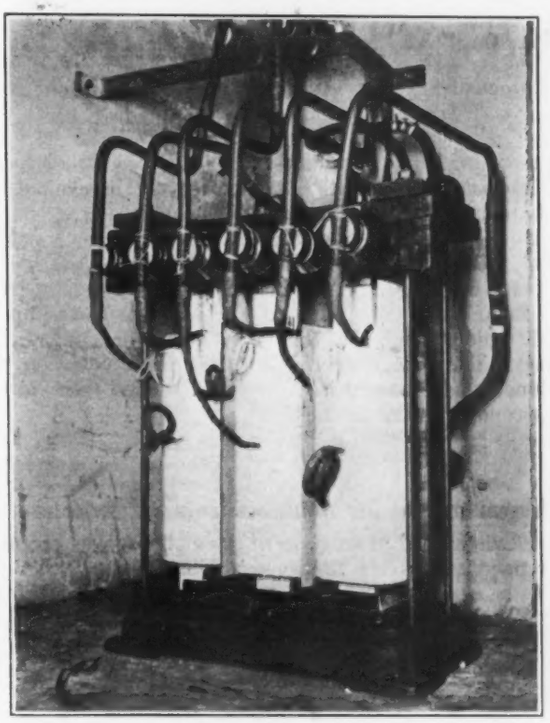


FIG. 1—CHOKE COILS SUBSTITUTED FOR STARTING COMPENSATOR

extensive use of the apparatus. The original apparatus consisted of three reactance coils wound on some discarded single-phase transformer cores having the desired cross-section and dimensions. On starting a machine the coils were connected in series with the wires supplying the motor with electricity and arranged so that they were short-circuited only after the field of the synchronous machine

was excited, and so adjusted as to produce the lowest armature current reading.

Several advantages were noticed in connection with their use. At no time is the full line voltage impressed across the machine when the field is unexcited, because the power-factor is poor and the drop over the coils is considerable. Serious damage cannot result from the short-

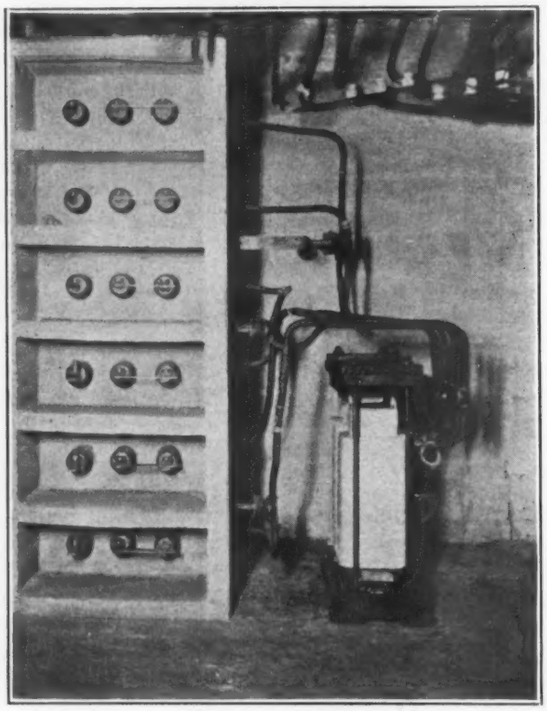
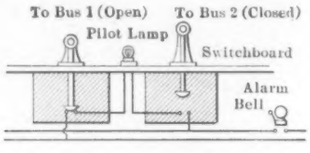


FIG. 2—REACTANCE STARTER AND CONCRETE SWITCH COMPARTMENT

circuit of any of the windings, since the coils are in series with the machine terminals. When the field is excited the machine may slip one pole, and if reactance coils are in the main line leads, the process is accomplished more gradually as the current cannot rise to a high value through the reactance coils. A very gradual rise in speed results from the use of these coils, and yet the machine comes up to speed rapidly since the voltage rises as the current decreases. The time which is consumed in accelerating the machine from standstill to full speed ranges from forty-five seconds to sixty seconds.

Alarm Circuit for Double-Throw Oil Switches

The switchboard of an Eastern power house was recently rearranged to provide for duplicate buses onto either of which the generators could be thrown by means of pairs of



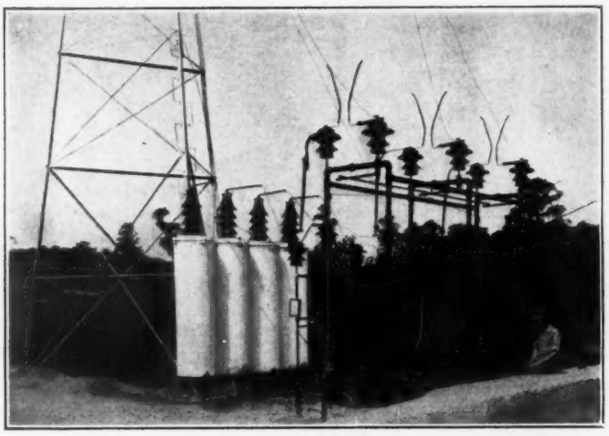
ALARM CIRCUIT FOR DOUBLE-THROW OIL SWITCHES

interlocked oil switches. Later a circuit-breaker alarm and pilot-lamp scheme was applied to the single-throw switches on the board, so that upon the opening of any breaker a bell would ring and a lamp on its panel would be lighted. To extend this system to the double-bus section caused the station wireman some worry, because one switch or the other of each interlocked pair would be open at all times and yet the bell must ring if for any reason the closed member opened. The difficulty was, after a little thought, solved as shown, double contacts being provided at each switch and the pair connected in series. The oil switch which is open has its own signal contacts closed. Opening of the other switch closes its contacts and thus, completing the circuit, sounds the alarm.

Maintenance of Electrolytic Arresters

By W. W. McCullough

The value of the aluminum-cell electrolytic lightning arrester for protection against lightning and abnormal voltage conditions depends upon the proper maintenance of the film on the surface of the plates making up the arrester. The maintenance of this film depends, first, on the temperature of the electrolyte, and, second, on the frequency of "flashing" or "charging." The operation of electrolytic arresters, given proper "charging," presents very little difficulty in climates where the electrolyte is not subjected for long periods of time to high temperatures. In semi-tropical countries with the arrester tanks exposed to the sun, however, it is extremely hard to keep up the film on the plates,



LIGHTNING-ARRESTER INSTALLATION

only a few hours being sufficient to dissolve the film immersed in the warm electrolyte.

This trouble has been remedied to a large extent on a 60,000-volt system in Florida by painting the arrester tanks white instead of black as originally furnished, advantage being taken of the increased heat-reflecting qualities of a white surface as compared with a black one. The photograph shows an arrester for 60,000-volt service with the tanks so treated.

Counter-Emf Control of Storage Batteries

In the telephone field use has been made of the counter-cell principle of voltage control for regulating the terminal emf of storage batteries used with central-energy systems. Has this method ever been applied commercially for central-station batteries? With the large currents to be handled, such a scheme should save much of the investment in end-cell switches. L. F. G.

At St. Louis, Mo., such a 5750-amp-hr., 150-cell stand-by battery has been in service in a substation of the Union Electric Light & Power Company for a year. Six pairs of subtractive counter-emf cells are connected in series with each half of the battery, being short-circuited by magnet switches to raise the effective terminal voltage. The scheme avoids much terminal and end-cell coppper. A similar battery equipment, but smaller, is being installed in the Public Service building of The Milwaukee Electric Railway & Light Company.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Reduction of the Excitation Time of Coils with High Self-Induction.—W. WEILER.—In direct-current machines in which the magnetic flux is to be regulated it is often necessary to reduce the excitation time of the field coils as far as possible. Six different methods for accomplishing this result are described. The three most important ones are the use of a series resistance, the use of a counter-compounded excitation machine, and the use of an excitation machine driven by a motor the speed of which decreases with increasing load.—*Elek. und Masch.* (Vienna), May 25, 1913.

Induction Law and Electron Theory.—K. PICHELMEYER.—The well-known mathematical formulations of the law of induction are in all cases applicable in principle although they are not of the same practical ease of application in all cases. The electronic theory supports the conception of induction due to the cutting of lines of force. The emfs are induced right at those points of the conductors where lines are cut. One is, therefore, justified in distinguishing between active and inactive portions of the windings of generators. The magnetic lines of force are physical realities, though perhaps only phenomena of motion, like water-waves. An application of the electronic theory is made to transmission of energy from the primary to the secondary of a transformer.—*Elek. und Masch.* (Vienna), June 1, 1913.

Lamps and Lighting

Lighting by Neon Vapor Tubes.—G. CLAUDE.—An account of a lecture presented before the joint meeting of the (British) Institution of Electrical Engineers and the Société Internationale des Électriciens in Paris. Neon has the peculiar property that it can be thrown into a state of luminescence by the application of much lower voltages than are required for other gases, for example, 13 volts as compared with 1000 volts for air. Moreover its spectrum in some respects is remarkably good. It gives an orange-red light, but unfortunately is deficient in the blue end of the spectrum, so that it departs considerably from the spectrum of daylight. Thus it lacks the part of the spectrum which is such a prominent feature of the mercury lamp, and the idea naturally arises that the light of one may be used to correct that of the other. Unfortunately this cannot be done by simply adding neon to a tube containing mercury. If that be attempted, the tube starts glowing readily owing to the high conductivity of the neon, but the light from the neon very soon passes away and the spectrum of mercury alone remains. Therefore, it is only possible to correct the light in this way by running neon and mercury tubes side by side. Another difficulty is that neon is very sensitive to impurities. In fact, the presence of the smallest quantities of other gases renders a tube ineffective. It is, therefore, insufficient to fill a tube with pure neon, as impurities are given out by the electrodes. This difficulty has been overcome by connecting the tube when first run to a vacuum vessel containing charcoal. The current is allowed to pass under these conditions for several hours, after which the charcoal may be removed, the neon being thus purified. Still another difficulty was found owing to the volatilization of the electrodes. This not only caused a deposit of metal upon the glass, but the electrodes absorbed the neon in the process, thus rendering the tubes unworkable. The difficulty, however, was overcome by increasing the surface of the electrodes, which are of copper. Tubes are now obtained with a life of from 1200 to 1300 hours, taking 800 volts for a length of 6 m. The potential drop at an electrode is about 150 volts, so that the longer the tube the more efficient the result. The current may be varied from 0.6 amp to 1.3 amp in a 45-mm tube, but the lower the current the redder the light. A 6-m tube carrying 1 amp gives about 900 candles, and the power factor is about 0.8. Consequently with 800 volts the power is 640 watts, giving a specific consumption of 0.72 watt per candle. If the loss in the transformer and the accompanying self-induction is taken into account, a specific consumption of 0.9 watt per spherical candle is obtained. The advantages over the Moore lamp are that the potential is less, the candle-power per meter is greater and the efficiency is higher. The light can be corrected by neon tubes containing mercury, which, unlike the ordinary mercury tubes, work with the same current as the pure neon tubes. The specific consumption is then about 0.8 and 0.9 watt per candle. In an editorial note on the subject it is stated that a very fair spectrum may be obtained by running a neon tube together with a mercury tube, yet at Paris it was quite evident that the result was not perfectly correct, for when the light was extinguished and the ordinary light was turned on the white reflectors over the latter appeared quite green for a time. It is thought that the sphere of such lamps will be restricted to certain special classes of illumination, such as large halls, or to advertising purposes, rather than domestic lighting.—London *Electrician*, May 30, 1913.

New York City Street Lighting.—C. F. LACOMBE.—An illustrated article on the street lighting and fixtures of New York, the plan of development and present condition.—*Elec. Journal*, June, 1913.

Traction

Electric Locomotives of the Berlin Electric Railways.—E. C. ZEHME.—In the projected electric equipment of the Berlin City and Ring Railway it is proposed to use electric locomotives in order to use the cars at present employed with steam locomotives. The author endeavors to show that this is a wrong idea and points out the superiority of motor cars over electric locomotives for the purpose in question.—*Elek. Zeit.*, May 29, 1913.

Installations, Systems and Appliances

Prices Charged for Electrical Energy.—S. SIMPSON.—The author thinks that an average depreciation or writing off of capital account of a central station within fifteen years should be allowed for and, therefore, suggests that for municipal stations the period for loans should be only fifteen years. On this basis he shows that most of the British municipal stations are operating at a loss with their present rates for energy. He discusses the question whether the price of energy supplied to manufacturers cannot be raised. His final conclusion is that "so far as regards examples taken for the supply industry, to obtain 15 per cent of capital outlay for interest and depreciation, say, at 8.7 per cent. + contingencies, 2 per cent, + net true profit, 4.3 per cent, the present revenue, which is making a loss approximately 0.85 per cent of capital, will require increasing by something like 45 per cent of the

present value on the present load connections—that is, revenue should be 23.5 per cent of capital with works costs 34.5 per cent of revenue. This is the task ahead of the commercial electric supply engineer." In an editorial on the subject doubt is expressed whether it is correct to require that the period for loans should only be fifteen years for municipal stations. For certain classes of plant this may not be too short, but as an average it is thought to be far shorter than is really necessary. It is doubtful whether it would be possible to charge higher rates to manufacturers. "A supply authority cannot expect to sell electrical energy unless it can be clearly demonstrated that such a course is to the user's advantage. This may mean that the price that is quoted is of necessity low, but whether it is too low to be remunerative will generally depend upon the size of the undertaking giving the supply. It may be necessary to work for a time at unremunerative rates, and thus to provide for the future, but there is nothing uncommercial in this if it seems likely to have a successful issue."—London *Electrician,* May 16, 1913.

Flat Rate.—Hans Bergmann.—An article on the development of the flat-rate tariff of the Upper Silesian Electricity Works. Right from the beginning, 1896, this company has permitted consumers to use a flat rate, and since 1906 it has been using devices limiting the power consumption in all installations where the flat rate is charged, the kilowatt-year being charged at $75. In 1909 the flat rate was further reduced, since experiments had shown that in the installation using a flat rate the number of hours of use was very rarely more than 1500 a year. Under this condition the rate would have been $60 per kw according to the meter tariff. The rate for the flat-rate tariff was, therefore, made $61.50 for 1 kw, $31.50 for 500 watts, etc. In installations in which it is proved that the electricity is used for more than 1500 hours a year these rates are increased by $15 per kw. The number of installations using the flat rate has increased from 5200 in 1909 (receipts $60,000) to 16,300 in 1912 (receipts $196,000), while the number of installations using the meter tariff has decreased from 7800 in 1909 to 5100 in 1912. A possible danger is the greater use of electric heating and cooking apparatus, and if this takes place in this district it has not yet been decided whether it will be possible to retain the present flat rate or whether it will be necessary to increase it in view of the longer hours during which electricity will be used.—*Elek. Zeit.,* May 29, 1913.

Austria.—Emil Honigmann.—The first part of a statistical report on the condition of the electrical industry in Austria in 1912. On Jan. 1, 1913, there were in Austria 854 central stations with a total rating of 457,000 kw and total connections of 568,000 kw supplying electrical energy to about 2000 cities and towns. The connections included 5,000,000 incandescent lamps (230,000 kw), 43,500 arc lamps (22,250 kw), 65,700 motors (196,320 kw) and 2000 heating and cooking apparatus (11,230 kw). The author gives a review of the relation of the electrical industry to the general industrial life of Austria and gives extended tables of the import and export trade in electrical goods. The article is to be continued.—*Elek. und Masch.* (Vienna), June 1, 1913.

Wires, Wiring and Conduits

Installation Materials.—The new rules of the German Association of Electrical Engineers on the construction and testing of installation materials, such as switches, fuses, sockets, pipes, switchboards, etc. The rules will be in force beginning with Jan. 1, 1915.—*Elek. Zeit.,* May 29, 1913.

Cable Sheathing.—A note on a recent British patent (No. 16,153, 1912) of the Weston Electric Company. To decrease the cost of cable sheaths, an alloy of approximately 99 per cent lead and 1 per cent antimony is used. The alloy is preferably formed by combining the metals after they have been reduced to their natural state.—London *Elec. Eng'ing,* May 29, 1913.

Overhead-Line Regulations.—The revised model regulations of the (British) Board of Trade for overhead lines together with some explanatory notes.—London *Electrician,* May 30, 1913.

Electrophysics and Magnetism

Efficiency of the Electromagnet.—L. Schueler.—The first part of a mathematical paper in which the author gives the energy balance of the attraction of a load by an electromagnet. There is transformation of electric into mechanical energy. This transformation is double. The current passing through the winding of the electromagnet produces a magnetic field so that electrical energy is changed into magnetic energy, there being losses due to ohmic resistance and to the eddy currents in the iron core. The magnetic energy is stored within the magnetic circuit and especially in the air-gap. When the armature is attracted to the electromagnet the magnetic energy stored in the air-gap is changed into mechanical work while the magnetic energy in the iron core remains there. This is set free in the form of an arc when the circuit is broken and is thereby lost. The author discussses mathematically what happens while the armature is being attracted. The article is to be concluded.—*Elek. Zeit.,* May 29, 1913.

Periods of Transformation of Uranium and Thorium.—Herbert N. McCoy.—The period of a radioactive element can be calculated with considerable accuracy from its range and the ionization current of the unit weight. The period so found of uranium and thorium are 5.0×10^9 and 1.8×10^{10} years respectively.—*Phys. Review,* May, 1913.

Alpha-Ray Ionization.—Herbert N. McCoy.—A paper in which a formula is developed for the alpha-ray activity of a lever of a radio-active solid as a function of its thickness. It is assumed that the air range of an alpha ray is diminished in its passage through the solid by an amount directly proportional to the distance it travels in the solid before emerging and that the ionization produced is proportional to the two-thirds power of the distance the alpha-ray then travels in air. The theoretical curve for the rise of activity with increasing thickness of the layer is almost the same as an exponential curve, although the fundamental equations are entirely different. It is shown that the activity of a film of any alpha-ray substance just thick enough to give maximum activity is 0.3 of the activity that the same material would have if spread on a flat surface in an infinitely thin film. The partial activities of a thick film which gives equal numbers of alpha-rays of ranges R_1 and R_2 are in the ratio $(R_1/R_2)^{2/3}$ It is found experimentally that the activities of films of U_3O_8 were in good agreement with those calculated by theory. The weights per square centimeter of U_3O_8 and of air which produce equal retardation of an alpha-ray are as 3.01 to 1. This ratio is approximately that calculated by the law, first stated by Bragg and Kleeman, that the stopping power of matter is approximately inversely proportional to the square root of the atomic weight of the material through which an alpha-ray passes.—*Phys. Review,* May, 1913.

Units, Measurements and Instruments

The Constant of the Radiation Law.—The Planck-Wien radiation law

$$E = C_e^{\frac{\lambda^{-5}}{c/\lambda T \cdot 1}}$$

is of fundamental importance not only for the theory of radiation but for the practice of optical pyrometry. E is the radiation of the wave-length λ, e the basis of natural logarithms, T the absolute temperature (=degrees Celsius

$+273$), C a constant depending on the instrument and c a natural constant. The knowledge of the value of c is, therefore, very important. According to Lummer and Pringsheim $c = 14{,}600$, if λ is measured in microhms. The value of c has recently been redetermined at the Reichsanstalt by E. Warburg, G. Leithäuser, E. Huka and C. Müller. Their result is $c = 14{,}370 + 40$.—*Ann. der Physik*, 4 Folge, page 609, 1913; abstracted in *Zeit. f. Beleucht.*, May 30, 1913.

Units, Measurements, and Instruments

National Physical Laboratory.—An account of last year's work of the (British) National Physical Laboratory. F. E. Smith has nearly completed the measurements necessary to determine the absolute value of the resistance of the international ohm, and his report indicates the high order of accuracy which may be expected. The laboratory standards of resistance have been again compared with those of the Bureau of Standards, the Reichsanstalt and the Laboratoire Central d'Électricité. The maximum difference is eleven parts in 1,000,000; the laboratory and the Reichsanstalt agree within one part in 1,000,000. The value found at the Bureau of Standards was one part in 100,000 greater. In the photometric division the most important researches have been the determination of the candle-power of a set of twenty-four tungsten lamps running at 1.5 watts per cp, an investigation for the Board of Trade into the visibility of ships' lamps, and a large number of tests for the engineering standards committee on metallic-filament lamps. Another series of investigations for the same committee has been made on the heating of lamp sockets, while much information has been obtained for the Admiralty on the dielectric properties of ebonite and mica. The following table gives a summary of the tests carried out at the laboratory during the last three years:

	1910	1911	1912
Electrical measurements	186	290	340
Electrotechnics	1,796	2,182	2,512
Photometry	480	920	782
Thermometry	496	582	3,721
Optics	5,308	5,106	2,810
Metrology	10,126	12,054	13,267
Taximeters	28,492	29,719	31,268
Engineering	159	283	620
National tank	.....	5	9
Observatory	36,395	37,145	40,912

As to work proposed for the year 1913, the report reads in part as follows: "Further measurements of resistance will be made with the Lorenz apparatus, and the coils will have their dimensions re-measured. The equilibrium of the Weston cell will be further studied, and if necessary a large number of cells containing free acid will be set up as secondary standards. A few of the new mercury standards of resistance will have their constants redetermined in order to detect any secular change. It is proposed to make experiments with the Ayrton-Jones current balance having as their object the accurate measurement of the mean value of a variable current. A new magnetometer, suggested by Prof. Schuster, will be built. A determination of the mechanical equivalent of heat will be commenced. At present the values given for the equivalent when obtained by electrical methods differ by one part in 1000 from the values obtained by mechanical methods. For the wave-meter it is proposed to improve further the apparatus for the production of the high-frequency oscillations. It is hoped to complete the low-reading marble inducto-meter and to improve the methods of testing the very small residual inductances which are found in good modern resistance coils. It is proposed to continue the investigation on the magnetic testing of rods and strips, including magnet-steel tests, and incidentally the more accurate determination of the areas of search coils; while in connection with the research committee of the Institution of Electrical Engineers some experiments on the steel most suitable for magnets may be undertaken. It is hoped to set up more sensitive vibration galvanometers, as experience has shown that, with a scale distance of 7 m, a good sharp light-spot can be obtained, with a sensitivity of 250 mm per micro-ampere at 100 cycles per second. The fixing of the unit of candle-power by a cascade method in tungsten-filament lamps, operating at 1.5 watts per candle, is now complete, and work is in hand to ascertain the order of agreement shown when a flicker photometer is used to bridge the color difference between the pentane lamp and the unit so obtained. A few details of this work need to be completed. As regards international comparisons, it remains only to complete the tests which are in hand with the Laboratoire Central, Paris. The intercomparisons during the past year with Germany and the United States have shown close agreement between the laboratories of these countries and Great Britain as to the unit of luminous intensity whose radiation is of the same hue as high-efficiency tungsten lamps. Preliminary work is in hand to ascertain the suitability of the Violle molten platinum standard as a primary standard of luminous intensity, having regard to the more recent knowledge of the principles underlying the radiation from bodies of this nature. Work is contemplated in the direction of further perfecting the installation for measuring alternating-current power. The increasing severity of specifications for electrical machinery renders the accurate calibration of test instruments a matter of considerable importance, and it is necessary that these calibrations shall be made both quickly and with precision. The steadiness of the supply obtained from running machinery is one of the factors which affect accuracy, and good results are anticipated from the use of mercury contacts for leading away current from the moving parts. Previously in the calibration of three-phase wattmeters the instruments have been tested on three-phase circuits with their series instrument transformers only, the shunt transformers having their ratios separately determined. Plans are now prepared for switch apparatus which will permit such meters to be tested on three-phase circuits with both their series and shunt transformers in circuit. Additional standard water-tube non-inductive resistors are to be constructed to complete the series which have now been in daily use for the last four years. Other chapters of the report are devoted to the work proposed in the field of thermometry, metrology, optics, metallurgy and metallurgical chemistry. The article is to be concluded.—London *Electrician*, May 23, 1913.

Telegraphy, Telephony and Signals

Loaded Telephone Lines.—A note on a recent British patent (No. 7903, 1912) of F. A. Becker. To regulate the attenuation in telegraph and telephone lines according to the different frequencies, inductances are inserted at equal distances. There are specially arranged compound shunts, which may be tuned to different frequencies.—London *Elec. Eng'ing*, May 29, 1913.

Wireless Telegraphy.—A brief illustrated account of the quenched-spark method of wireless telegraphy which is said to give exceptionally good results in tropical countries. It is stated that an efficiency of 50 to 75 per cent is obtained in transforming the primary electrical energy into useful radiated energy.—London *Electrician*, May 30, 1913.

Wireless Telegraphy on the Eiffel Tower.—In connection with the visit of the (British) Institution of Electrical Engineers to Paris the wireless-telegraph station at the Eiffel Tower is described. The method at present employed is what is known as the "rare-spark" system. In this method resonance is employed in the alternator circuit such that the spark only passes when the pressure through resonance is sufficiently high. The more usual spark methods provide a spark which passes at every maximum of the alternator pressure wave—that is, twice in each complete wave—so that the spark frequency is double that of the

alternator. In the rare-spark method the spark gap is set too wide for a discharge to take place when the pressure due simply to the alternator and its transformer reaches its maximum value in each half alternation. The necessary pressure is then obtained by tuning the alternator circuit. For this purpose both inductance and capacity must be present, and the circuit must be tuned to such a frequency

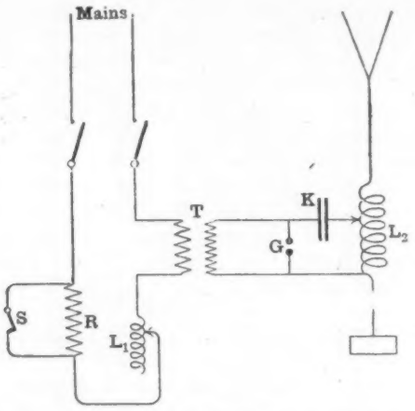


FIG. 1—CONNECTIONS OF MAIN CIRCUIT

that the pressure can build up conveniently. Thus the sparking pressure is not reached at the first maximum in the wave after closing the primary circuit, but in the present instance at the third. If K is the capacity of the secondary, L the inductance of the primary, m the transformation rato and $p = 2\pi f$, then the condition of resonance is $m^2p^2LK = 1$. The primary frequency in the large installation is 42, varying up to, say, 46, thus giving a spark frequency of 28-30. The connections of the main equipment of 60-kw rating are shown in Fig. 1. Energy is taken from the public mains at 220 volts and 42 cycles. After passing through the switchboard it is taken to the primary of the transformer T, in series with which is the tuning inductor L and the resistor R. The resistor of R is such that when it is in circuit the pressure given by the secondary of the transformer is insufficient to cause a spark, and the method of signaling consists in short-circuiting the resistor whenever a spark is desired, the alternator circuit being thereby rendered resonant. The secondary of the transformer is taken to the spark-gap G and to the resonating circuit, including the capacity K and the inductance L_2 in the aerial circuit. In addition to the main installation there is a small one of 10 kw on the rare-spark system, and also one of 22 kw giving musical sparks. A description is

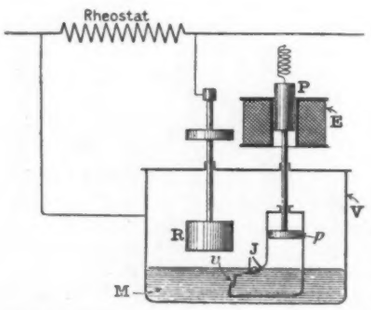


FIG. 2—RELAY DEVELOPED BY COMMANDANT FERRIÉ

finally given of the arrangement for giving the daily time signals. These are given directly from the observatory, the relay being connected to the observatory for this purpose and being thus actuated directly by the special observatory clock. This relay in turn brings into action a second relay, which short-circuits the rheostat, thus giving the necessary signals. The difficulty in a relay of this kind is that it deals with considerable currents, and that the time taken for its operation must be quite definite if the signals are to have any serious value. Commandant Ferrié developed a relay shown in Fig. 2. It consists essentially of a vessel V, containing mercury M and a rotating electrode R which is above the surface of the mercury. The terminals of the rheostat are connected respectively to the vessel and to the electrode. The vessel contains further a small mercury pump, of which the piston is indicated at p. When the piston draws up it draws mercury in through the valve v into the pump, and when it is forced down it drives mercury out through the jet J against the rotating electrode. When this happens the rheostat is short-circuited and the spark passes. The piston p is actuated by the plunger P, forming the core of an elecromagnet E. Normally the plunger is kept up by a spring and is pulled down when the electromagnet is energized by the relay connected to the observatory. In order to suppress sparking on the rotating electrode the vessel is filled with coal gas. It is found that the relay is quite definite, with a lag of 0.2 second between the closing of the circuit at the observatory and the passing of the spark at the aerial circuit.—London *Electrician*, May 30, 1913.

Miscellaneous

British Electrical Engineers in Paris.—A full account of the visit of the (British) Institution of Electrical Engineers to Paris and its joint meeting with the Société Internationale des Électriciens. Features of the technical sessions were discussions on electric traction and on long-distance energy transmission. An account is given of the many visits which were paid to the Asnieres three-phase station, the 120,000-hp St. Denis station, the Eiffel Tower, etc.—London *Electrician*, May 30, 1913.

Book Reviews

Sur les Effets Physiologiques des Courants Électriques. By Dr. G. Weiss. 86 pages, 26 illus. Paris: Gauthier-Villars. Price, 5 francs.

A valuable physiological series of researches on the effects of electric currents upon dogs. They were made systematically and with great care, using both electrical and physiological indicating and recording instruments. As a broad generalization it is pointed out that when the effect of the electric shock was to set up fibrillatory tremor in the heart the animal promptly died. It was found that the alternating current was more dangerous than the direct current. A variation of frequency of the alternating current between the limits of twelve and seventy-five cycles per second had no apparent influence on the effects of the shock. The observations also indicate that while there is no appreciable danger to life from 110-volt alternating-current service in buildings when an accidental contact occurs between a person and the service, yet such service may be very dangerous if contact is made with large moist electrodes. For example, it is very unsafe to place wiring near metal baths in houses in such a manner that a person standing in the bath can come in contact with the circuit.

Transmission-Line Formulas for Electrical Engineers and Engineering Students. By Herbert Bristol Dwight. New York: D. Van Nostrand Company. 138 pages. Price, $2.

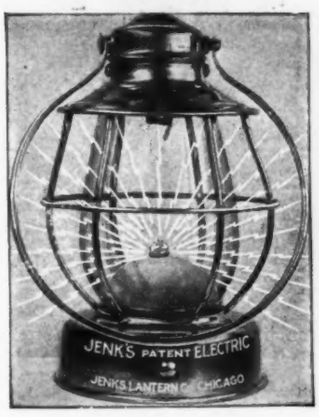
This book gives the theories and working formulas of transmission lines in a brief manner. The subject is, of course, one of the most complex that can be treated, and it appears as if the author had successfully grappled with its difficulties. Whether it is possible to do justice in a brief treatise to problems so involved and complex is an open question.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Trainman's Lantern

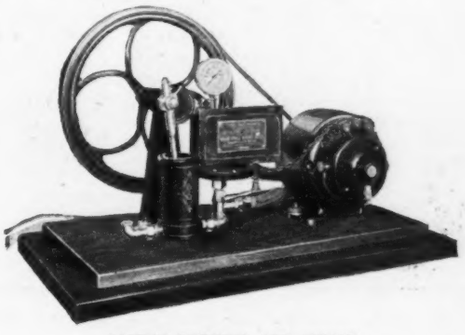
Trainmen's lanterns equipped with electric incandescent lamps were among the new devices shown at the National Electric Light Association convention recently held in Chicago. The lantern is similar to those used by conductors and brakemen, with the exception that light is furnished by a 3.5-volt, 1.5-cp incandescent lamp instead of by an oil lamp. The base of the lantern, which ordinarily serves as a reservoir for oil, contains a small three-cell battery. Instead of manipulating a switch or button to turn on the light, all that is required is to put the handle in an upright position (which is the natural position when carried by a trainman). To extinguish the light the bail is dropped to one side. Connections between the battery, electric lamp and handle-operated contact are concealed in the wire guard surrounding the globe of the lantern. The outfit complete weighs only 2.25 lb., and it is asserted that the battery will give fourteen hours' continuous service or twenty-eight hours' intermittent service. The lantern is manufactured by the Jenks Lantern Company, Chicago.



TRAINMAN'S LANTERN

Automatic Electric Air Compressor

The single-cylinder, motor-driven air compressor shown in the illustration is particularly well fitted for use in saloons, doctors' and dentists' offices and by air-brush artists. It is claimed by the manufacturer that it will furnish a uniformly strong pressure of filtered air. The air is drawn through water, which removes dust, tobacco smoke and foul odors. This is of importance when the apparatus is used in saloons for drawing beer. It is said to be very economical in operation as it operates only when air pressure is required, the whole apparatus being entirely automatic. The cost of operation is said to be ½ cent per barrel of beer. The apparatus is delivered complete, ready to be connected to feed wires and air pipes. It is inclosed in a cabinet with oak or mahogany finish and glass panels on all sides. It is made by the Varwig Manufacturing Company, 120 Opera Place, Cincinnati, Ohio.



MOTOR-DRIVEN AIR PUMP

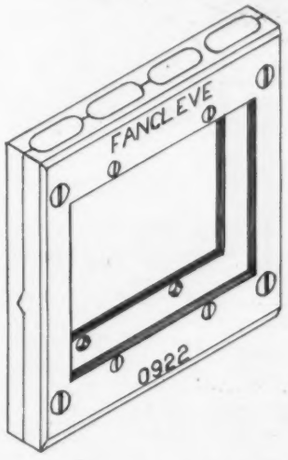
Angle Mission Socket with Shell Cap

An angle-type mission socket has been placed on the market in which the solid cap with the right-angle bend has been eliminated. Wires supplying the socket with electricity enter through a bushing which is integral with the body of the socket. The cap is made of pressed brass and is secured to the body of the socket by small screws. The advantages attributed to this design are the elimination of right-angle bends in which the insulation on wires is liable to be bruised, the reduction in weight due to the cap construction, and the support of the entire weight from the body of the socket instead of from the cap. The fixture is manufactured by the Benjamin Electric Manufacturing Company, Chicago.

ANGLE-TYPE MISSION SOCKET

Switch Mats for Metal Moldings

The Fancleve Specialty Company, Jamaica Plain, Mass., has developed a line of adapters or switch mats for use with metal moldings in single-gang, two-gang, three-gang and four-gang sizes, the illustration showing the two-gang size. The base or lower deck of the adapter is secured to any concealed switch-box after the switches or receptacles have been removed, holes being provided for the screws at points coincident with standard spacing for switch-boxes. There are more molding entrances at the top than the number of switches for which the adapter is designed and at the bottom the number of ports is equal to the number of switches. The adapter may, however, be reversed and in this way it will accommodate the larger number of moldings from either direction. All the entrances are provided with removable seals. The cap is fastened to the base by four machine screws and the switches or receptacles may be remounted on the upper deck. The flush plate conceals all screw heads.



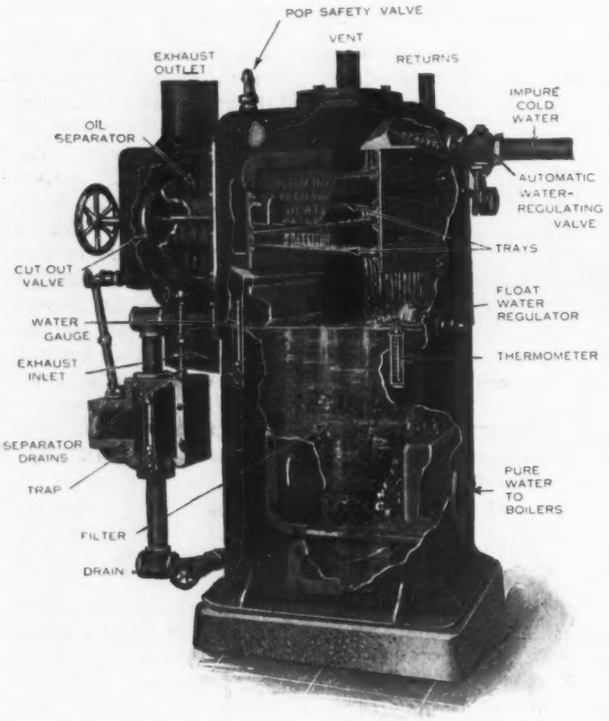
TWO-GANG ADAPTER

Single-Casting Feed-Water Heater

The substitution of a single casting as the body of a feed-water heater for the customary built-up plate body does away with bolts and calked joints at all points except at the oil separator, the manhole and handhole covers and the pipe fittings. A feed-water heater called the Cookson one-piece heater which is being brought out by the Bates Machine Company, of Joliet, Ill., embodies this feature, and it is claimed that the increased solidity of construction gained will permit higher pressures without danger of leakage or bursting of plates.

The heater which is shown in the illustration has ample steam space, tray surface and filtering space and is provided with four manholes and hand-holes to facilitate cleaning. As cleaning doors are located on two sides of the heater, it can be made to fit into a limited space without causing complications in the piping.

An oil separator is provided for the heater in either of



FEED-WATER HEATER

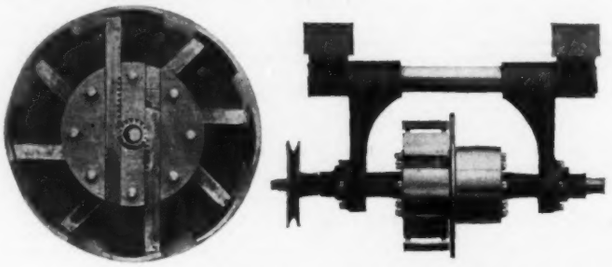
two types, namely, the cutout-valve type, purifying all of the exhaust, or a separator which permits the heater to be piped on the induction or thoroughfare principle and purifies only a portion of the exhaust.

A steam trap and return opening are provided so that the heater may receive the wet steam from a steam-heating system if desired.

Speed Regulator

A variable-speed jack shaft allowing a three-to-one range in speed is being put upon the market by the S. & S. Variable-Speed Gear Company, of 50 Church Street, New York City. The so-called "Scriven speed regulator" consists of two expansion pulleys bolted together and mounted on tubular shafts which are shrunk into side plates forming the outside of the built-up hub. The illustration shows the pulley with the side plate removed to illustrate the method employed in expanding and contracting the rim sections of the pulley.

The pinion shown in the center of the boss is in mesh with all of the spokes of both pulleys. There are two spokes to each rim section, and as the pulleys are assembled right-handed and left-handed, turning the pinion expands the rim of one pulley and at the same time contracts the rim of the other. The spokes are staggered so that they do not interfere with each other, and as may be seen from the illustration, there is still two-thirds of the length of the spoke within the hub when the pulley is expanded to its



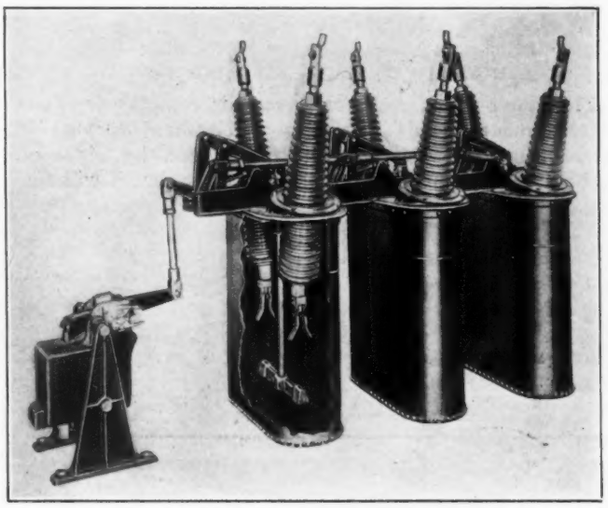
INTERIOR OF PULLEY AND REGULATOR COMPLETE

greatest diameter. When the operating wheel at the end of the jack shaft is turned the motion is transmitted through a tubular shaft to the pinion. It is claimed that the long pitch of the spiral grooves on this shaft eliminates the possibility of speed alteration due to vibration.

In operation the load is carried entirely by the two expansion pulleys and is equally balanced by the pinion, the running shaft being free to move back or forward until the strain from the load on each belt becomes equal. The tension on the two belts is always the same, for when the speed is changed one pulley takes up just the amount of belt length that the other looses, and the running shaft automatically swings into adjustment. It is claimed that the power loss with this type of speed regulator is much less than with other speed-varying devices.

Self-Contained High-Voltage Oil Switch

The accompanying illustration shows an oil switch recently developed by the General Electric Company for use in central stations employing open wiring. Among the



SOLENOID-OPERATED, TRIPLE-POLE, SINGLE-THROW OIL SWITCH

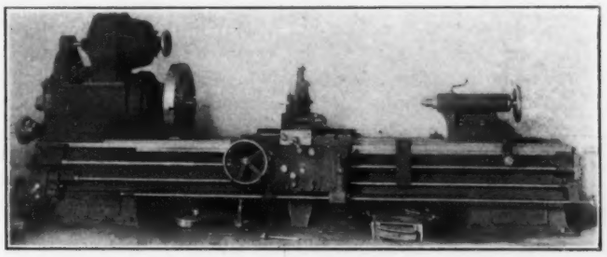
most important improvements embodied in this switch are rearrangement of the bushings, reducing the size of the oil tank which is needed for any particular voltage, and a change to self-contained operating mechanism which makes the switches easier to install and allows the smaller units to be shipped completely assembled. The sliding-wedge type of contact which is employed obviates burning of the

working surfaces and keeps the contacts clean by a rubbing movement when the switch is operated.

The tank is made of boiler iron, lapped, riveted, reinforced and calked. The switch can be operated by hand, by a direct-current solenoid or by an air diaphragm and can be tripped automatically by the usual methods.

Motor-Driven Heavy-Duty Lathes

The motor-driven lathe here shown, which is a product of the Reed Prentice Company, Worcester, Mass., is built to withstand the strain of constant heavy turning. It is equipped with quick-change gear boxes giving fifty-four changes. Three reductions of motor speed are possible by gearing and ten changes by the controller, giving in all

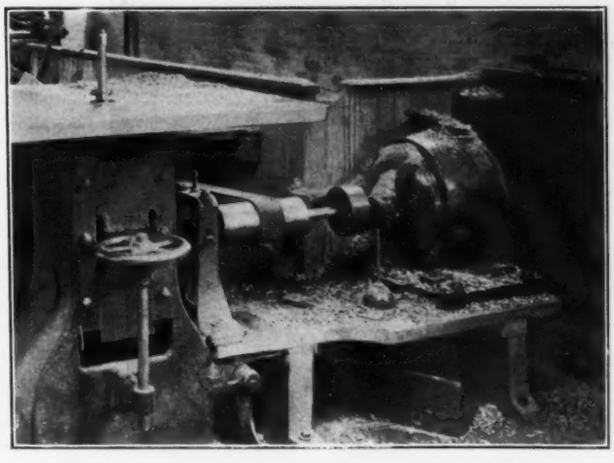


27-IN. HEAVY-DUTY MOTOR-DRIVEN LATHE

thirty spindle speeds. The fastest and slowest spindle speeds are 172 and 5.5 r.p.m. respectively. The apron feedworks are driven by worm and gears. There are double friction drives for lengthwise and cross feeds. The lead is equipped with thread-cutting index. The hand wheel shown on the end of the motor shaft is used to turn the face plate in chucking the work to be machined. The machine is driven by a Westinghouse semi-inclosed 11.5-hp motor.

Motor Drive with Outboard Bearing

A good example of outboard-bearing motor drive, where jack shafting or direct coupling is not permissible owing to location of machine, is shown by the accompanying illus-



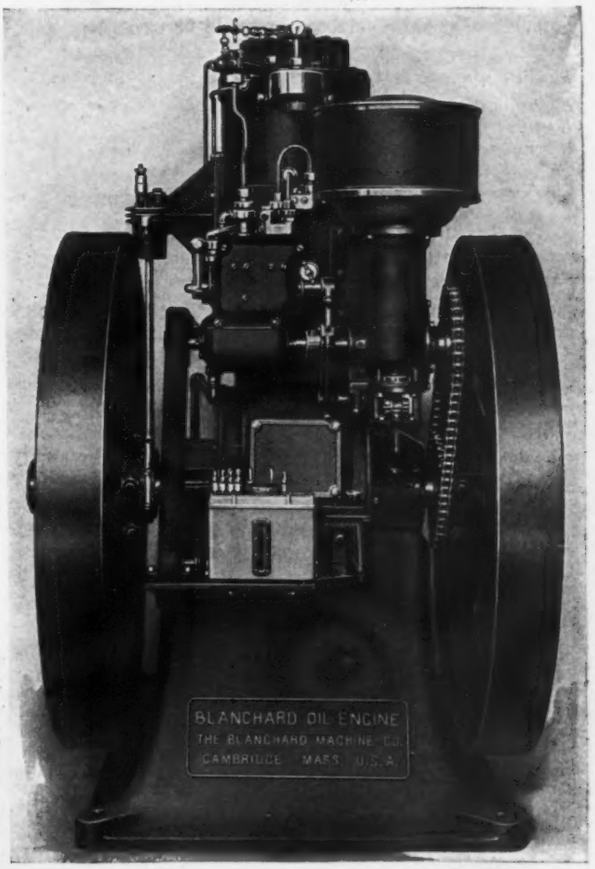
OUTBOARD BEARING WITH MOTOR DRIVE

tration. An upright molder in a woodworking shop is driven by a 3-hp electric motor running at a speed of 1600 r.p.m. The armature shaft of this motor is connected with a 3-ft. shaft extension by a rigid coupling and is supported by an outboard bearing. This motor is entirely inclosed with iron covers and operates continuously at a temperature of less than 50 deg. C. Automatic control is utilized in connection with wholly inclosed motors throughout the shop, reducing the danger of fire from arcs or sparking. The motor shown in the illustration was built and installed by the Diehl Manufacturing Company, of Elizabeth, N. J.

Crude-Oil Internal-Combustion Engine

The Blanchard oil engine uses kerosene or light fuel oils on a modification of the Diesel principle, without the extremely high compression of the purely Diesel type.

The liquid fuel is injected into the combustion chamber after the charge of fresh air has been compressed. This fact is said to make the engine very economical at partial loads, while the explosion of the charge at every revolution gives a more even torque and allows the use of a smaller



20-HP SINGLE-CYLINDER OIL ENGINE

cylinder to produce a given power than would be required in the four-stroke cycle.

The illustration shows a single-cylinder engine of 20 hp with 10-in. bore and 10-in. stroke, fitted with flyball governor in the cylindrical casing to the left of the right-hand flywheel. This engine is built with from one to four cylinders, and as there are two different sizes of cylinders standardized, 6½ in. by 6 in., and 10 in. by 10 in., there are eight distinct sizes of engine, ranging from 8 hp to 100 hp.

The crank case is built air-tight. As the intake port is covered by the piston except at the top of the stroke, the upstroke of the piston creates a slight vacuum in the crank case and the space below the piston. At the highest point the piston uncovers the intake port and permits the inrush of air to fill the partial vacuum previously formed. Closing the intake port on the down stroke compresses this air to about 5 lb. per sq. in. At the lower end of the stroke the piston opens the transfer port and permits the passage of this compressed air into the combustion end of the cylinder,

where it drives out the burned gases of the previous charge through the regular exhaust port.

It is said that this engine will operate on oil or any of the distillates obtained during the refining process with specific gravities between 26 deg. and 50 deg. Baumé. The grades between 30 deg. and 40 deg. Baumé are said to be the best. These oils must not contain over 0.3 per cent of sulphur if the combustion chamber is to be guarded against pitting. The makers stated that with any of the above oils the engine will produce 1 hp-hr. on 0.1 United States gallon of fuel containing at least 19,000 lb. Fahr. thermal units per pound.

The governor is powerful and sensitive enough to hold the engine speed to a variation of about 2.5 per cent from no load to full load. This makes the engine particularly suitable for driving electric generators and other machines requiring close regulation. It is said to produce results so quickly that the variation in speed can scarcely be noticed before the engine is running at its normal speed again.

This engine is manufactured by the Blanchard Machine Company, Cambridge, Mass.

Midget Ammeter and Voltmeter

In the midget ammeter or voltmeter here shown use is made of a tungsten steel magnet of unusually large size to obtain permanency and to improve the dead-beat operation of the instrument. This magnet has no pole pieces, the poles being accurately ground. This plan eliminates the magnetic joint between the magnet and the pole pieces and also increases the magnetic strength. The bases are of molded material to insulate the studs carrying the current through the switchboard or dashboard, and this material is used so that the magnetic strength may be unaffected. To obtain the greatest strength from the magnets the covers are made of brass instead of iron.

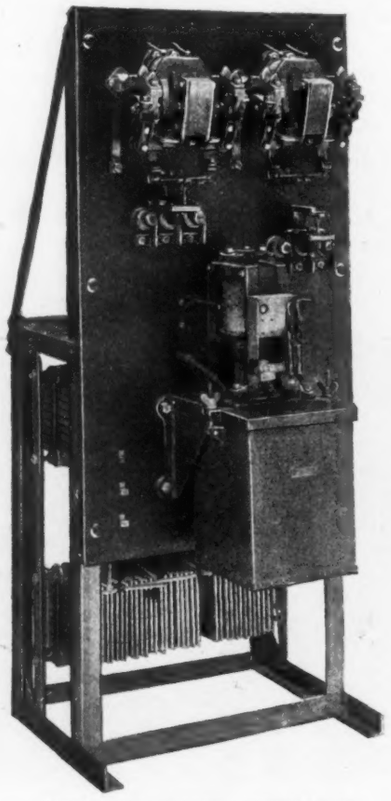
The aluminum coil form, 0.007 in. in thickness, on which the fine enameled wire is wound, swings in sapphire jewels between the poles of the magnet. The pointer is of aluminum tubing 0.012 in. in outside diameter and with a wall 0.001 in. thick. The whole moving element weighs only slightly more than 0.1 gram, or the weight of one common pin. With a moving element so exceedingly light the instrument is claimed to be absolutely dead-beat in operation, and the pointer is said not to oscillate, although the instrument is subject to severe vibration. This light moving element also has the advantage that there is practically no weight on the pivots and bearings. Each instrument is equipped with a zero adjusting device by means of which the pointer can be readjusted to zero at any time from the outside of the case. These meters have been developed by the Keystone Electrical Instrument Company, Philadelphia, Pa., for use on switchboards.

PORTABLE VOLTMETER

Automatic Controllers for High-Voltage Motors

Motors connected directly to 2200-volt and 1100-volt systems are now coming into general use. At this high voltage it is especially desirable to provide automatic starting apparatus. For this purpose the Cutler-Hammer Manufacturing Company, Milwaukee, has designed a new line of high-tension automatic-control panels. One type is designed for use with motors driving reciprocating pumps, air compressors or other machines which must be started under full-load conditions and which require a starting torque equal to or in excess of the normal full-load torque of the motor. The other line, having the same appearance as that shown in the illustration, is designed for use with motors driving centrifugal pumps or machines of similar load characteristics starting under light-load conditions.

The acceleration is controlled by resistance in each of the three phases of the rotor, which is cut out, step by step, by double-pole magnetic switches under the control of current relays. By adjustment of the relays the starting current can be set at a predetermined value and the motor accelerated in the shortest time consistent with this current. An oil-immersed, solenoid-operated, three-pole switch is also mounted on the panel which controls the high-tension motor primary circuit. Where used on water systems, air or vacuum systems, suitable accessories such as float switch, gage and diaphragm-type pressure regulators and vacuum regulators are available.



AUTOMATIC MOTOR CONTROLLER

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Business Outlook in Mexico.—Walter Ennes, president of the Buckeye Electric Lamp Company, with headquarters in Mexico City, while in New York last week on a short business trip stated that as far as the Mexican electrical industries are concerned the recent political upheaval has had no appreciable effect, business being a little better at this time than ever before.

Sales of Special Alloys.—Particularly large sales have been made recently by Herman Boker & Company, of New York, in their line of special thermostatic metal for use in temperature regulating and recording devices. Excellent sales are also reported by the same concern for its "Excello" resistance metal, which finds application in all classes of electric heating and cooking devices.

Stone & Webster Properties Large Buyers.—Through Stone & Webster, of Boston, Mass., orders have been placed for turbo-generating equipment, transformers and switchboards by the Blackstone Valley Gas & Electric Company, the El Paso Electric Railway Company and the Rio Grande Valley Traction Company. The apparatus is to be supplied by the Westinghouse Electric & Manufacturing Company.

Bruce-Macbeth Natural-Gas Engines Popular.—Recent sales of Bruce-Macbeth natural-gas engines have aggregated over 550 hp. Among the concerns from which these orders were obtained are the Chicago Pneumatic Tool Company, the Scott-Ulman Company, of Cleveland, Ohio; the Wallaceburg (Ontario) Gas Company and the H. C. Fry Glass Company, of Rochester, Pa. The 150-hp engine ordered by the latter company makes the third one of the same size and type furnished to it by the Bruce-Macbeth Company.

Storage-Battery Cars for the New York Railways Company.—Storage-battery cars are to be put in operation shortly by the New York Railways Company on its Spring and Delancey Street line, between the Grand Street ferry on the East River and the Desbrosses Street ferry on the North River, replacing the present horse-car service. The operating conditions on this line are unusual in several respects, traffic being light at the terminals but heavy in the middle part of the run. It is estimated that during rush hours it will be necessary to run the cars on a one-minute headway. The cars are being supplied by the American Car & Foundry Company, the motors and control equipment by the General Electric Company, and the storage batteries by the Electric Storage Battery Company.

Sprague Electric Works Have Large Western Sales.—The Chicago office of the Sprague Electric Works of the General Electric Company report that they have a very large amount of prospective business at present, and that the building equipment department has recently closed a number of good-sized orders for generators, galvanized conduit, panelboards, cabinets and switchboards. Among the purchasers of this equipment were Sears, Roebuck & Company, for their warehouse and plant at Dallas, Tex.; the Central High School, Minneapolis, Minn.; the Gordon-Ferguson Building, St. Paul, Minn.; the Great Northern Railway, for its depot at Minneapolis, Minn.; the Selz-Schwab Shoe Company, of Chicago, and the Shields Building and Northeast High School at Kansas City, Mo.

Carbon-Filament Lamps Still Made in Large Quantities.—The independent manufacturers of carbon-filament incandescent lamps call attention to the fact that although an attempt is being made by the large manufacturers of lamps to discourage the use of the carbon-filament lamp in the interest of the tungsten lamp, the patents for which they control, as well as the output, except for the small quantity of high-efficiency lamps imported, first quality, carbon-filament lamps are still being made in large quantities. Last year there was an output of approximately 8,000,000 carbon-filament lamps, the greater part of which were of independent manufacture. These were sold by the independents at the prevailing 16-cent base rate, and the opinion is expressed that a first quality carbon-filament lamp cannot be manufactured and sold with profit at a lower list rate.

Motor-Generator Sets for San Francisco Companies.—The Oakland, Antioch & Eastern Railway Company and the Pacific Gas & Electric Company, both of San Francisco, Cal., will each install in the near future a synchronous motor-generator set of Westinghouse manufacture, the former a 750-kw machine and the latter one of 1000-kw rating.

Electrical Supplies for the Municipal Building in New York.—An order for over 5000 of its No. 6541 receptacles and plates has been placed with the Manhattan Electrical Supply Company for installation in the new Municipal Building in New York City. The company claims that this is the largest order ever placed for this type of equipment for a single building.

Lightning Arrester Sales.—Word comes from the Electric Service Supplies Company, of Philadelphia, Pa., that it has been working its factory day and night for several months in order to meet the great demand for Keystone steel gear cases and Garton-Daniels lightning arresters. From all present indications the company looks forward to a record-breaking sale of this apparatus for the year 1913.

New Quarters for the Duncan Company.—A four-story brick factory is in process of construction for the Duncan Electric Manufacturing Company, of Lafayette, Ind.—the foundation and part of the first story being finished at the present time. Pending the completion of this building the company has been forced to rent 25,000 sq. ft. of extra floor space from the Lafayette Electric & Manufacturing Company, in order to take care of the rush of new business.

Telephone Exchange for Tientsin, China.—An order was recently received by the Western Electric Company for a common-battery telephone exchange, including switchboard, cable and subscriber sets, for installation at Tientsin, China. The present equipment will care for 4000 subscribers and have an ultimate capacity of 14,000. There are fairly good-sized exchanges in Pekin, Hongkong and Shanghai, but the installations in other towns are small and out of date.

Recent Large Sales of Steam-Boiler Equipment.—Among the recent sales of steam boilers reported by the Babcock & Wilcox Company, of New York, and aggregating over 29,000 hp, were the following to electrical companies: 1024 hp to the Erie County Electric Company, of Erie Pa.; 3764 hp to the Philadelphia (Pa.) Rapid Transit Company, 3300 hp to the Toledo (Ohio) Railways & Light Company, and 2412 hp to the San Joaquin Light & Power Company, at Bakersfield, Cal. The largest sale to an industrial concern was for 4222 hp in boilers to the American Sheet & Tin Plate Company, at Vandergrift, Pa.

Westinghouse Apparatus in Wide Demand.—In addition to those noted elsewhere in this issue, orders for self-starting rotary converters, synchronous motor-generator sets, portable substations, compound-wound, three-wire, direct-current generators, transformers and switchboards have been received recently by the Westinghouse Electric & Manufacturing Company, the equipment being destined for the following concerns: The Pittsburgh (Pa.) Railways Company, the Portland (Ore.) Railway Light & Power

Company, the South Covington & Cincinnati Street Railway Company, of Covington, Ky.; the Lehigh Valley Transit Company, at Allentown, Pa.; the Manhattan City & Interurban Railway Company, of Manhattan, Kan., and Messrs. Barnes & Payton, of Troy, N. Y. The apparatus ordered by the last-mentioned firm is for use in the Samaritan Hospital at Troy, N. Y.

Phenomenal Sales of Insulated Wire.—The Safety Insulated Wire & Cable Company, of New York, finds general business conditions in its line exceptionally good at present, the monthly sales figures for the past quarter showing increases of from 75 to 200 per cent over average figures. Last year's total sales amounted to about $3,350,000, and to date this year sales amounting to $2,200,000 have been made. Approximately 5 per cent of the total sales represent exports, and of these the greater proportion go to South America.

New Power Equipment for the Toledo Railways & Light Company.—Since control of the above company was gained by H. L. Doherty & Company, of New York, extensive additions to equipment have been planned. A 15,000-hp generating unit has been ordered from the General Electric Company for installation in the Water Street station, and the same order included about 2700 hp of boilers and other auxiliary equipment. There is now being built a 33,000-volt transmission line, 34 miles in length, which will skirt the city and supply energy to outlying industrial plants. Steel towers are to be used on this line, and it is understood that the company contemplates adding thirty cars to its rolling stock in the near future.

Rush Orders for Transmission-Line Material.—The Clark Electric & Manufacturing Company, of New York, reports that it has rush orders for its product of transmission-line specialties which will force it to work day and night shifts during the summer. For the first five months of this year sales were about 10 per cent larger than for the corresponding period of 1912, and the orders already secured seem to warrant the belief that for the rest of this year the factory will be worked to its full capacity. It is stated that over 5000 clamping sets of the various types manufactured have been furnished for use in the State of Pennsylvania alone, and that out of this number not a single defect or failure has been reported so far.

Electrical Equipment at St. Thomas Railroad Shops.—An emergency steam generating station and a locomotive repair shop are being erected at St. Thomas, Canada, for the Michigan Central Railroad. A 200-kw, 575-volt, three-phase, 25-cycle generating unit, driven by a reciprocating engine, the exhaust from which will be used for heating purposes during the winter months, will be installed. The greater portion of the electrical energy used in the machine shops and roundhouse will be purchased from the Ontario Hydro-Electric Commission through the municipal electric plant at St. Thomas. The emergency unit will be used only in the winter or in case the Ontario system becomes inoperative. In addition to installing about 1000 hp in motors throughout the new shop, the old equipment will be rehabilitated. The new repair shop will have about 50,000 sq. ft. of floor area. Construction work is being done by The Arnold Company, of Chicago.

Apparatus for Use on the New York State Barge Canal System.—Joint contracts were awarded a short time ago to the Lord Electric Company and to MacArthur Brothers Company, both of New York City, for the mechanical and electrical equipment of the Erie, Oswego and Champlain canals. This work includes the erection of twenty-eight power stations along the canal route, the supplying of machinery for operating lock gates and the installation of electric lights at various points. The two companies above mentioned as general contractors will complete all the masonry and field engineering work including the installation and wiring of electrical apparatus. The generators for the power stations and the motors for operating valves, lock gates and capstans, as well as the arc and incandescent lamps, are to be furnished by the General Electric Company. The Hyde Windlass Company, of Bath, Maine, and the Wheeling Mold & Foundry Company, of Wheeling, W. Va., hold a joint sub-contract for supplying the mechanical equipment for operating the lock gates and valves, this work being so extensive that it was thought best to arrange for a combination of two large concerns on it. Through Messrs. Wonham, Sanger & Bates, of New York, hand-power cranes for the generating stations are to be supplied by the Whiting Foundry Equipment Company, of Harvey, Ill. The Camden Water Wheel Works, of Camden, N. J., will furnish waterwheels for the hydroelectric stations, and the arc-lamp poles, 293 in number, are to be made by the Electric Railway Equipment Company, of Cincinnati, Ohio. The canal engineers have designed special steel turrets to cover the operating machinery at the locks, and these turrets are to be fitted with signal lights to indicate the exact position of the valves and gates for some distance along the approach to the locks. The turrets are to be manufactured by James McKinney & Son, of Albany, N. Y. The general contractors state that they hope to have all the machinery installed ready to operate for the opening of the canal to navigation in May, 1914.

Aluminum of Increasing Importance Industrially.—A large increase in the consumption of aluminum in this country was observed in 1912, more than 65,000,000 lb. being used during that year, as compared to 46,125,000 lb. in 1911. This was accompanied by a large increase in the imports of that metal. In the powdered form aluminum finds application as a paint pigment, in explosives, in printing and lithographing, and in a certain kind of welding. Aluminum foil is displacing tin foil owing to improved manufacturing methods. One of the recent developments, and one which is of particular interest to the electrical industries, is the production of a steel-reinforced stranded aluminum cable for use on transmission lines. It consists of six strands of aluminum wire surrounding a core strand of steel wire, and this type of conductor has been used by the Pacific Light & Power Company, of Los Angeles, Cal., on its recent transmission line extensions.

Reduction in Tungsten Lamp Prices.—As predicted exclusively in the *Electrical World* of April 26, the manufacturers of tungsten-filament incandescent lamps have arranged new price schedules, effective July 1, making a reduction in the list prices of tungsten lamps in standard package quantities of 12.5 per cent. The old and new prices of standard tungsten lamps follow:

TUNGSTEN LAMP PRICES

Package, Quantity	Rating, Watts	Old Prices (List) Plain	Old Prices (List) Frosted	New Prices (List) Plain	New Prices (List) Frosted
100	10	40	43	35	38
100	15	40	43	35	38
100	20	40	43	35	38
100	25	40	43	35	38
100	40	45	49	35	38
100	60	..	..	45	49
24	100	90	97	80	87
24	150	1.35	1.45	1.20	1.30
12	250	2.25	2.40	2.00	2.15
8	400	4.15	4.40	3.65	3.90
8	500	4.55	4.85	4.00	4.30

A Large Order for Storage Batteries.—The Electric Storage Battery Company, of Philadelphia, Pa., has recently received an order for forty-three storage battery sets which will be used for street-railway service on one of the cross-town lines of the New York Railways Company. This is the second large order for batteries for traction purposes received from New York by the Philadelphia concern, the first being for ninety sets now in use by the Third Avenue Railway Company. Each of these sets consists of fifty-eight cells of type MV-29 "Hycap-Exide" battery, having a rating of 67 amp for six hours continuous discharge, at an average of 114 volts. The weight of each set, including the containing trays, is 4880 lb., and the installation is placed under the car seats, utilizing space that would otherwise be wasted. One of the particular advantages claimed for storage-battery cars is that they may be operated on steam roads where the interval between trains is sufficiently great. Storage batteries were furnished for a service of this nature to the Lewisburg, Milton & Watsontown Passenger Railway Company, operating over the Lewisburg & Tyrone branch of the Pennsylvania Railroad, between Montandon and Mifflinburg, Pa.

American Companies Making Diesel Engines.—Since the expiration of the Diesel patents last year there has been active preparation in this country for extensive manufacture of this type of internal-combustion engine. Among the concerns planning to put out these engines are the Busch-Sulzer Company, of St. Louis, Mo.; the Fulton Iron Works, also of St. Louis, Mo.; the Electric Boat Company; the Otto Gas Engine Company, of Philadelphia, Pa.; the Lyons-Atlas Company, of Indianapolis, Ind.; the Dow-Williams Diesel Engine Company, of San Francisco, Cal., and the International Steam Pump Company, of New York.

Mexican Telegraph Company Imports Cable.—A few days ago there arrived in this country a shipment of 700 tons of submarine cable from Nordenham, Germany, destined for use by the Mexican Telegraph Company. This class of cable is not manufactured extensively in the United States, owing perhaps to several causes, among them the fact that the demand for the product is comparatively small and uncertain and that the gutta percha which forms an important part of the insulation has to be imported.

Further Reports on Utah Securities.—Supplementing the note of last week, reports have been received from the Electric Bond & Share Company showing for the Utah Securities Corporation gross earnings of $144,903 for May and $679,447 for the five months ended May 31. Net earnings for May amounted to $91,309, and for the first five months of 1913 to $398,410. These figures represent increases over the same items for last year of 22, 11, 52 and 14 per cent respectively.

Annual Report of the Philadelphia Electric Company.—In presenting the annual report of the Philadelphia Electric Company for the fiscal year ended Dec. 31, 1912, the following figures on the company's financial condition were given by President J. B. McCall: Gross earnings, $7,051,497.17; operating expenses, $5,385,307.61; cash dividends, $974,668.99; total surplus, $1,818,913.73. At the end of the year the company had 45,127 customers and a total commercial connected load, 50-watt equivalents, of 2,839,884, and, in addition, was supplying 20,800 hp to the street-railway companies. These figures represent in each case increases over those for 1911. During the year items were added to the construction account calling for an expenditure of $2,594,687.00, and for the year 1913 there are further extensions and replacements planned.

First Annual Report of Middle West Utilities Company.—Considerable interest attaches to the first annual report to the stockholders of the Middle West Utilities Company, made by President Samuel Insull. The company was organized on May 15, 1912, and the report (made public on June 11) is for the period of eleven and one-half months ended April 30, 1913. Since the close of the fiscal year, however, the directors have authorized the issue of $3,500,000 of three-year 6 per cent collateral gold notes secured by the deposit of bonds of subsidiary companies having par value of $4,667,000. Of these notes $2,000,000 will be sold immediately and the proceeds used to complete payments on properties heretofore contracted for and to provide funds for other purposes. The report is a satisfactory one. It shows net earnings equivalent to 4.7 per cent on the amount of common stock outstanding at the close of the fiscal year, as well as 6 per cent dividends paid on the preferred stock. If an amount of more than $100,000 of surplus, which still remains in the treasuries of subsidiary companies, had been included in the report of the Middle West company, the net earnings would have been equivalent to 6 per cent on the common stock. The company owns public-service properties in the States of Indiana, Illinois, Kentucky, Michigan, Missouri and Oklahoma, as well as the New England States. Except in Michigan, there is one subsidiary operating company or more in each state. The subsidiary companies serve 274 separate communities, having a combined population of over 800,000. The gross earnings of these subsidiary companies from the date on which they were acquired to April 30, 1913, were $3,680,676; operating expenses, $2,442,584, leaving net earnings from operation of $1,238,092. Deducting from this $801,657 for fixed charges to outside holders leaves $436,435 as the earnings accrued on securities of subsidiary companies held by the Middle West Utilities Company. The average time the properties contributing to this result have been under the control of the Middle West Company is only nine months and Mr. Insull remarks that these results have been obtained largely under adverse operating conditions which existed before the acquisition of the properties. These operating conditions are being improved rapidly by the completion of transmission lines and the replacement of numerous inefficient small generating plants by a limited number of modern, ecomonical generating stations. The total income of the Middle West company for the period named (not including the item of $100,000 in surplus in subsidiary companies) is $911,969. This is made up of interest on bonds and debentures, dividends on stocks, interest on notes receivable, brokerage and profits from the sale of properties. The total operating expenses of the Middle West company were $212,948. Thus $699,021 was available for dividends, from which $353,417 was paid in dividends on preferred stock, leaving a surplus of $345,603. The total assets of the company amount to $18,543,809, of which $15,923,632 consists of securities, plants, contracts, good-will, etc., at book value. The company had $1,068,595 in cash on April 30. The capital stock authorized consists of $12,000,000 in common and $12,000,000 in 6 per cent preferred stock. Of this $7,356,200 of common stock and $8,470,100 of preferred stock have been issued. The accounts are certified to by Arthur Young & Company, of Chicago, and Deloitte, Plender, Griffiths & Company, of London.

Business of Brooklyn Utility Companies.—The combined reports of the Kings County Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn show for the month of May gross operating revenues of $436,369.04, total operating expenses of $282,998.20, and a net income of $103,656.88. For the first five months of the year the figures for gross operating revenue were $2,345,087.21, for total operating expenses $1,441,416.65 and for net income $554,285.23. Both of the income items show a very substantial increase over the corresponding figures for 1912.

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	June 11	June 18
Allis-Chalmers, t.r., 5th pd	$19,800,000	.....	.....	6¼*	7¼*
Allis-Chal., pf.,t.r.,5th pd..	16,050,000	.....	.....	14*	13¾*
Amalgamated Copper.....	153,887,900	1½	Q	62¼	66⅛
American Tel. & Tel.....	344,471,400	2	Q	126	128
Electric Storage Battery,c.	16,074,425	1	Q	43¾	47½
General Electric.....	101,363,600	2	Q	130	136*
Mackay Cos., c.....	41,380,400	1½	Q	87*	88*
Mackay Cos., pf.....	50,000,000	1	Q	67*	69½*
Western Union Tel.....	99,747,600	¾	Q	60	63*
Westinghouse, E. & M., c.	34,496,400	1	Q	54½	60
Westinghouse, E. & M., pf.	3,998,700	1½	Q	110*	109½*

*Last price quoted.

NEW YORK METAL MARKET PRICES

	June 10 Bid.	June 10 Asked.	June 17 Bid.	June 17 Asked.
Copper:				
Standard, spot	13.87½	to 14.62½	14.00	to 14.50
	£ s d		£ s d	
London, standard, spot	65 5 0		64 17 6	
Prime Lake	....	15.12½	15.00	to 15.25
Electrolytic	....	14.87½	14.87½	to 15.00
Casting	....	14.75	13.75	to .....
Copper wire, base	16.00	to 16.25	16.00	to 16.25
Lead		4.35		4.35
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter		7.25		7.25
Spelter, spot	5.15	to 5.25	5.00	to 5.15
Tin, spot	45.00	to 45.25	44.25	to 44.75
Aluminum:				
Prompt delivery	25.37½	to 25.50	25.00	to 25.50
Future	25.37½	to 25.62½	25.00	to 25.50

OLD METALS

Heavy copper and wire	13.50	13.50
Brass, heavy	9.00	9.00
Brass, light	7.87½	7.87½
Lead, heavy	4.25	4.25
Zinc, scrap	4.12½	4.12½

COPPER EXPORTS

Total tons to June 17	13,829

Personal

Mr. W. F. Bogue has resigned as superintendent of the municipal lighting plant of Norwich, Conn.

Mr. F. M. Peyton has succeeded Mr. B. A. Little as superintendent of the municipal electric light plant at Okemah, Okla.

Mr. D. F. Webster has resigned as superintendent of the City Light & Traction Company of Sedalia, Mo., owing to ill health.

Mr. Robert E. Rae has associated himself with Stanley and Patterson, 23 Murray Street, New York, as sales manager of their factory lines.

Mr. George L. Hatheway, formerly in the New York office of Pass & Seymour, Inc., has been put in charge of the branch office at Toronto, Canada.

Mr. Frank J. Sprague, the well-known consulting engineer and inventor of New York, is at present sojourning in Italy in search of rest and recreation.

Mr. Charles H. Chandler, of Chicago, has been elected recently to the position of secretary of the Wirt Electric Specialty Company, of Germantown, Pa.

Mr. M. H. Flexner, illuminating engineer for the Commonwealth Edison Company, Chicago, was married on June 9 to Miss Marion Straus, of Chicago.

Mr. George D. Leacock, who has been with the Packard Company for three years, has been made manager of the Toronto office of the Canadian Moloney Electric Company, Ltd.

Mr. H. H. Barnes, Jr., engineer for the General Electric Company, New York, and president-elect of the New York Electric Society, is spending a six weeks' vacation touring Europe.

Mr. John L. Fay, lately with W. N. Matthews & Brother as sales engineer, has taken the position of superintendent of distribution for the Union Electric Light & Power Company, of St. Louis, Mo.

Mr. W. H. Atkins, general superintendent of the Edison Electric Illuminating Company of Boston, Mass., recently returned home from a Mediterranean trip and a visit to Egypt and the Holy Land.

Mr. Roy V. Wensley, formerly in charge of substations for the Merchants' Heat & Light Company of Indianapolis, has been appointed superintendent of the People's Light & Heat Company at Indianapolis.

Mr. H. H. Stephens has been appointed manager of the Everett Gas Company, which controls the electric service in Snohomish, Wash., succeeding Mr. M. D. Spencer, former manager at Snohomish.

Mr. Arthur Main, formerly electrical engineer of the Hot Springs (Ark.) Water & Light Company, is now electrical engineer of the Mammoth Springs (Ark.) Power Company, which operates a large hydroelectric system.

Mr. Delos F. Wilcox will sever his connection with the Public Service Commission for the First District, New York, on July 1 and will engage in private practice as a consulting franchise and public-utility expert.

Mr. B. R. Stephens has resigned as general superintendent of the Choctaw Railway & Lighting Company, McAlester, Okla., but will continue as secretary, auditor and purchasing agent, with headquarters in St. Louis, Mo.

Dr. Max von Recklinhausen, director of the Westinghouse Company, Paris, France, well known for his work with mercury-vapor lamps and quartz-tube water-purifying apparatus, is visiting this country in the interest of his company.

Mr. Henry L. Doherty will be the guest of the city of Denver on June 20, at which time he will preside at the functions attending the opening of the Antero reservoir irrigation project, which is capable of supplying water to over 60,000 acres.

Mr. Gunnar Tisell, for many years associated with the editorial department of the *Electrical World*, sailed last week for Sweden, where he has accepted a position on the editorial staff of the *Teknisk Tidskrift*, an electrical publication issued from Stockholm.

Mr. E. Thurnauer, managing director of the French Thomson-Houston Company, arrived in New York Tuesday on the S. S. *Kaiser Wilhelm II.* Mr. Thurnauer is on a short business trip to this country in connection with General Electric affairs in France.

Mr. C. B. Graves, formerly third vice-president and general manager of the Manila (P. I.) Electric Railroad & Light Company, has been appointed general manager of the Mexican Tramways to succeed Mr. H. Harrsen, who has been elected managing director of the company.

Mr. H. G. D. Nutting has resigned his position as district manager for the Central Illinois Public Service Company, with headquarters at Paris, Ill. Mr. Nutting was formerly manager at Fort Atkinson, Wis., and served for a time on the staff of the Wisconsin Public Service Commission.

Mr. H. E. Dunbar, for twenty years superintendent of the South Hadley Falls (Mass.) Electric Light Company, has with Mr. A. T. Chapin formed the electrical contracting and engineering firm of Chapin & Dunbar. Mr. Chapin was formerly superintendent of the Foster Electric Company, of Boston, Mass.

Mr. J. H. Bissell, for the past seventeen months assistant treasurer of the Paducah (Ky.) Traction Company and the Paducah Light & Power Company, has been appointed treasurer of the Mississippi River Power Company at Keokuk, Ia. Mr. Bissell is succeeded at Paducah by Mr. F. B. Flahive, of Dallas, Tex.

Mr. F. E. Hutchinson has resigned his position as chief electrician of the Rock Island lines to become sales manager of the Moon Manufacturing Company of Chicago. Mr. Hutchinson had served in the electrical departments of the Pennsylvania and Louisville & Nashville railroads before joining the staff of the Rock Island.

Mr. Harro Harrsen, general manager of the Mexican Tramways, has been elected managing director of the company to succeed Mr. R. C. Brown, who has been elected vice-president of the company. Mr. Harrsen is also managing director of the Pachuca Light & Power Company and of the Mexican Steel & Chemical Company.

Mr. George W. Magalhaes, who has served a year as assistant sales manager of the Toronto (Ont.) Electric Light Company, Ltd., has been appointed general inspector of that company. Mr. Magalhaes was born in 1876 at Sao Paulo, Brazil, came to the United States in 1892 and has since made his residence in this country and Canada. He was graduated from the School of Mines, Columbia University, with the degree of electrical engineer, in 1897, and his record of work and experience since then is as follows: He spent two years laying out and installing electric storage batteries for central-station and street-railway service. The next two years were spent with the Electric Controller & Manufacturing Company of Cleveland, Ohio, designing and selling electric controllers for rolling-mill machinery, cranes and ore-handling apparatus. The six years following Mr. Magalhaes was in the employ of the New York Edison Company in the engineering department laying out and inspecting substations and inspecting the electrical contract work on Waterside station No. 2. He served two years as inspector for the department of water supply, gas and electricity of New York City, giving especial attention to the electrification of the Queensboro and Manhattan bridges and the public buildings on Blackwell's Island, and up to the time of his affiliation with the Toronto company he was Canadian representative of the L. K. Comstock Company, electrical contractor of New York.

Obituary

Charles W. Morse, president of the Gainesville (Fla.) Gas & Electric Company and a native of Haverhill, Mass., died at Gainesville on June 11 at the age of sixty. Mr. Morse at one time owned the gas plants at Marlboro and Quincy; Mass., and Rochester, N. H., and was one of the owners of the Amesbury (Mass.) Gas & Electric Light Company.

Construction

New England

BANGOR, MAINE.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 7 for construction of the United States post office at Bangor, Maine, except mechanical equipment and approaches. Drawings and specifications may be obtained at the above office or from the custodian of site at Bangor. O. Wenderoth is supervising architect.

CLINTON, MASS.—The power plant of the Lancaster Mills was damaged by fire recently, causing a loss of about $14,000.

SOUTH HADLEY FALLS, MASS.—At a special town meeting held June 2, the proposition to establish a municipal electric-light plant was carried. A second vote will have to be taken on the proposition within a year.

HARTFORD, CONN.—Bids will be received by the Board of Contract and Supply of the city of Hartford, at the office of the Mayor, until June 24 for furnishing complete 100 double cast-iron lamp standards. Bidders will also be required to submit a price for any additional single or double lamp standards in excess of the number specified. Plans and specifications for the above may be seen and blank forms of proposals obtained at the office of the Board of Street Commissioners. Joseph Buths is secretary.

Middle Atlantic

BINGHAMTON, N. Y.—The Board of Contract and Supply has advertised for bids for the erection of a power house on Noyes Island and the placing of poles, stringing of wires and other necessary work in the completion of the system. Engineer Sprague will furnish the printed specifications for intending bidders. The bids will be opened at a meeting of the board on July 2. One section of the municipal lighting plant is expected to be in operation before the expiration of the contract with the Binghamton Lt., Ht. & Pwr. Co., 18 months hence. Douglas Sprague, 39 Cortlandt Street, New York, is consulting engineer.

NEW YORK, N. Y.—Bids will be received until June 26 by Patrick A. Whitney, Commissioner of Correction, for furnishing material and installing complete lighting-plant equipment in the Seventh District prison, West Fifty-third Street, New York City.

SCHENEVUS, N. Y.—The Great Bear Lt. & Pwr. Co., of East Worcester, which recently purchased the local electric-light plant, is preparing to erect a transmission line from East Worcester to Worcester and through the latter village to this village.

JOHNSTOWN, PA.—The Citizens' Lt., Ht. & Pwr. Co., of Johnstown, will soon begin work on the installation of the ornamental street-lighting system on Franklin, Clinton and Washington Streets. The plans provide for the installation of 46 lamp standards carrying five-lamp clusters.

NEW CASTLE, PA.—At an election held June 3 the proposition to issue $200,000 in bonds to establish a municipal electric-light plant was defeated.

SOMERSET, PA.—The Citizens' Lt., Ht. & Pwr. Co., recently organized, has applied to the Council for a 20-year franchise in Somerset. If granted a franchise, the company offers to inaugurate a day service. Thomas E. Gallagher, Robert Uhl and Allan B. Cunningham, of Somerset, are interested in the company.

CAMDEN, N. J.—John W. Emery is estimating on plans and specifications for a municipal lighting plant for the city of Camden, N. J. Runyon & Carey, Newark, N. J., are the engineers and architects.

MADISON, N. J.—The Eastern Pennsylvania Pwr. Co., of Easton, Pa., has submitted a proposition to the Borough Council offering to furnish electricity from its plant in Boonton, now under construction, to operate the local system.

TRENTON, N. J.—Plans are being considered by the Public Service Corpn. for the construction of a power plant on the Delaware River, near Burlington, to cost about $1,000,000, to furnish electricity for lamps and motors and to operate electric railways.

AUBURN, MD.—Decision on the proposition to erect boulevard lamps for seven business blocks has been delayed temporarily. E. O. Little is clerk at Auburn.

North Central

FLINT, MICH.—The Council lighting committee and the Chamber of Commerce are co-operating to secure a new lighting system for Saginaw Street. It is proposed to discard the present arc system and substitute the boulevard lighting system.

MONROE, MICH.—N. D. Carpenter, of Detroit, was the purchaser of the Dundee (Mich.) lighting plant in its various corporate names at the sale by the Circuit Court Commissioner here on the foreclosure of the mortgage of the Security Trust Co. of Detroit. Mr. Carpenter's bid was $24,800, leaving a deficit of upward of $12,000. He was the only bidder. Mr. Carpenter proposes to improve and operate the plant, which now has a rating of about 300 hp and supplies electric energy for public and private lighting and for industrial purposes in Dundee.

BARBERTON, OHIO.—The City Council has passed an ordinance providing for an issue of bonds amounting to $110,000, from the proceeds of which a municipal light plant will be built. The bonds will be dated July 1 and will bear interest at the rate of 5 per cent. The last of the securities will be due in 1933. They will first be offered to the sinking fund committee and then to the commissioners of the sinking fund of the school board. What they do not take will be offered for sale in the usual way. The contract for lighting the streets with gas will expire this fall, and it is the intention, if possible, to have the new plant in operation at that time. Underground conduits will probably be laid.

CLYDE, OHIO.—The town of Cylde has just completed the erection of a new power house and installation of one 150-hp boiler. It will install within the next 10 days two engines and two generators and switchboard; the whole town will be rewired for a tungsten street-lighting system; ornamental street lamps will be erected on one street, to be maintained by underground wires; 25 three-arm ornamental lamp-posts will be used. N. B. Dirlam is clerk.

COSHOCTON, OHIO.—The Lafayette Lt. & Pwr. Co. will buy its energy from the United Service Company, Scranton, Pa. G. L. Bascom is the engineer in charge of the work at Coshocton.

FINDLAY, OHIO.—The proposition to issue bonds to the amount of $57,000 to install an electrical distributing system was defeated at the election held June 3.

LANCASTER, OHIO.—We are advised that no definite steps have been taken toward the installation of a municipal electric-light plant. As yet no engineer has been engaged. D. B. Tidd is clerk of Council.

PAULDING, OHIO.—Contracts were awarded recently for equipment for the municipal electric-light plant as follows: To the Ridgeway Dynamo & Engine Co., of Ridgeway, Pa., for two 80-kw units complete; Fort Wayne El. Works, Fort Wayne, Ind., switchboard, meters and transformers; F. Bissell El. Co. and W. G. Nagle El. Co., for line material, and the Weimer Pump Co., of Columbus, Ohio, for two deep-well pumps and one centrifugal pump for station. L. O. Farnsworth is superintendent.

RIPLEY, OHIO.—An election will be held June 24 to vote on the proposition to issue bonds for the purchase of the gas and electric plant of the Ripley Gas Lt. & Coke Co.

ROCKFORD, OHIO.—The Rockford Ltg. Co. has purchased poles and materials for extension of its transmission lines in the country 1½ miles west and 1 mile east of Rockford to furnish electricity for lamps and motors to farmers. The company furnishes electrical service in Willshire, 8 miles distant, and Wren, 4 miles from this city. S. J. Robinson is manager.

WARRENSVILLE, OHIO.—Bids will be received at the office of the director of public safety, 109 City Hall, Cleveland, Ohio, until June 25 for furnishing and installing lighting fixtures in buildings of the Infirmary Group, Cooley Farms, Warrensville, Ohio, in accordance with plans and specifications which may be seen at the office of J. Milton Dyer, architect, 825 Cuyahoga Building, Cleveland. Charles W. Stage is director of public safety.

WOOSTER, OHIO.—The Wooster El. Co. expects to purchase within the next two months one 350-kva generator. Curtis V. Hard is president.

LEXINGTON, KY.—The Transylvania University will establish a $50,000 central heating and lighting plant for the service of all of its buildings. R. H. Crossfield is president.

LOUISVILLE, KY.—The Louisville & Nashville Railroad Company is installing an electric block system on its lines.

LOUISVILLE, KY.—The Realty Investment Company will establish an electric-light and power plant for the service of a new apartment building which it is erecting at Fourth and Ormsby Streets, and adjoining buildings.

BLUFFTON, IND.—The Public Utility Commission has authorized the issue of $20,000 in bonds by the city of Bluffton for improvements to the municipal electric-light plant, including the installation of an engine, two new boilers and other equipment. The total cost of the work is estimated at $25,223.

GOSHEN, IND.—The state utility commission is considering the plans of Burns & Macdonald, Kansas City, Mo., for remodeling the entire municipal lighting plant. The new plans include standard posts, lamps and an up-to-date lighting system for the business district.

ORESTES, IND.—The American Gas & El. Co., of Alexandria, is contemplating extending its transmission lines to Orestes. If given a contract by the Village Board for street lighting, the company will extend its service here and erect a transformer station.

ERIE, ILL.—The Rock River Lt. & Pwr. Co., of Sterling, has been granted franchise to furnish electricity in Erie for a period of 25 years. The company was also awarded a contract for street lighting.

GOLCONDA, ILL.—The Golconda Lt. & Wtr. Co. has installed a new Ideal engine, purchased from A. L. Ide & Son, of Springfield, and a 75-kva, three-phase, 60-cycle, 2300-volt Westinghouse generator, directly connected with a new switchboard for same. When improvements are completed a day service will be established. R. H. Williamson is superintendent.

PEARL CITY, ILL.—The Lena El. Lt. & Pwr. Co., of Lena, has been

granted a franchise to furnish electricity for lamps and motors in Pearl City. A transmission line will be erected from Lena to Pearl City to furnish the service. W. Benfer, of Lena, is president of the company.

ROCKFORD, ILL.—Sealed bids for furnishing the material for the installation of thirty new arc lights, as per specifications on file, will be received on or before June 26. E. A. Wettergren is city clerk.

DE PERE, WIS.—The De Pere Lt. & Pwr. Co. has been awarded the contract for lighting the streets.

NESHKORO, WIS.—Preparations are being made by the Neshkoro Lt. & Pwr. Co. for the installation of an electric-light plant here. The equipment of the proposed plant will include one Samson waterwheel (rating not yet decided upon), one 150-kw, 60-cycle, 2400-volt vertical-type generator, purchased from the Electrical Machinery Co., Minneapolis, ten General Electric type transformers, four 30-kw, four 10-kw and two 5-kw; overhead-line material will consist of 500 cedar poles, No. 6 bare copper wire for 9 miles of three-phase transmission line; 100 Westinghouse type meters and 40 200-cp tungsten lamps for street lighting. C. T. Dahlke, of Neshkoro, is engineer in charge.

RANDOLPH, WIS.—Within the next month or two the municipal electric-lighting plant will purchase a 100-kw directly connected 220-volt generator. J. O. Jones is the clerk at Randolph.

RIPON, WIS.—Within the next two months the Ripon Lt. & Wtr. Co. expects to erect a 6600-volt transmission line to supply the village of Green Lake with electricity. The Green Lake Electric Company will handle the local distribution.

BARNESVILLE, MINN.—The municipal electric-light, water and telephone plant, of which H. H. Pierce is superintendent, is planning an extension to its water-works.

BEMIDJI, MINN.—We are informed that the plant of the Warfield El. Co. at Warfield was not destroyed as reported in the issue of June 7. The generator was burned out by the electrical storm and the coils have been replaced. C. W. Warfield is president and manager.

DETROIT, MINN.—The City Council has adopted a resolution authorizing 100 ornamental electroliers to be placed on Washington Street and Pioneer Street, bids for which will be received until July 7. E. J. Bestick is city clerk.

ELLSWORTH, MINN.—At a special election held recently the proposition to issue $8,000 in bonds for the installation of a municipal electric-light plant was carried.

LAKE PARK, MINN.—A special election will shortly be held to consider issuing $10,000 for the erection of an electric-light plant. Ira Shannack is clerk at Lake Park.

ONAMIA, MINN.—The village of Onamia has decided to call a special election to vote on the proposition of bonding the village for the purpose of establishing a municipal electric-light plant.

SPRING VALLEY, MINN.—The electric plant of the Spring Valley El. Lt. & Investment Co. is reported to have been purchased by the Rutledge Brothers, of Glencoe.

WINDOM, MINN.—A special election will be called to vote on the proposition to issue $15,000 in bonds for improvements and extensions to the municipal electric-light plant and water-works system.

WOOD LAKE, MINN.—The question of installing an electric-light system in Wood Lake is under consideration; also securing electricity from Granite Falls is being considered.

ARMSTRONG, IA.—The City Council has planned to install fourteen additional street lamps.

CHARLES CITY, IA.—We are informed that the city of Charles City has decided not to establish a municipal electric-light plant and has made arrangements with the local lighting plant for lighting the city for a period of three years. John S. Bradley is city clerk.

EARLY, IA.—The proposition to issue $7,000 in bonds for the installation of an electric-light plant will be submitted to the voters.

EAST PERU, IA.—The Peru El. Lt. & Pwr. Co., recently granted a franchise, will install an electric-light system. The equipment of the proposed plant will include a gasoline engine and a 220-volt direct-current Triumph generator; 100-watt Mazda lamps will probably be used for street lighting. The plant will have an output of 19 hp. F. A. Herweke is superintendent.

ELDON, IA.—Work on the new building of the Eldon electric-light plant, which will give twenty-four-hour service, is progressing, and the new machinery will soon be installed.

ESTHERWOOD, IA.—The electric-lighting plant is almost complete. Some of the apparatus has been installed, and it is expected to begin operation shortly.

LIPTON, IA.—The business men of this city have petitioned the City Council for boulevard lamps.

LYONS, IA.—The installation of an ornamental street-lighting system is contemplated by the Commercial Club. A tentative plan calls for erection of 50 standards to carry five-lamp clusters. The cost of electroliers is estimated at $38 each. With four 60-watt lamps and one 100-watt lamp the cost would be $55 per standard.

MILTON, IA.—Work has begun on the construction of the new power plant in Milton. The Town Council has awarded the company a contract for street-lighting. The contract provides for 30 lamps. Walsh Brothers, of Burlington, are interested in the company.

MONONA, IA.—The village of Monona has granted F. L. Wellman & Son a franchise to construct and operate an electric-light plant for a period of 25 years.

OSSIAN, IA.—H. Bullard, who will install an electric-light plant here to provide for street and commercial lighting, will shortly be in the market for a 25-kw generator, an oil engine, overhead line material and meters.

SIOUX CITY, IA.—The Baker Const. Co. plans the construction of an interurban line between Sioux City and Omaha. Construction work on the power dam at Niobrara, Neb., has been begun.

VALLEY JUNCTION, IA.—The Iowa Engineering Co., Clinton, Ia., has charge of the work of the construction of the electric generating plant to be erected here, plans for which are under way, as mentioned last week.

WASHINGTON, IA.—Bids will be received by the city of Washington, Ia., until June 23 for materials and supplies for changing and extending the municipal street-lighting system, including 87 three-lamp Cutter Riverside ornamental lamp posts, 81 two-lamp posts, with extensions to take line 23 ft. above ground, 300 25-ft (6-in. top) cedar poles with not more than 5-in. crook one way, 36,500 ft. miscellaneous wire, 5050 ft. galvanized conduit, etc. St. Clair Lewis is superintendent.

WATERLOO, IA.—The Waterloo, Cedar Falls & Northern Ry. Co. expects to purchase in the near future three 500-kva, 2300-4400-volt step-up transformers.

WATERLOO, IA.—The Citizens' Gas & El. Co. has purchased the property of the Crystal Ice & Fuel Co. at the head of Sycamore Street, which will be used as a site for the new electric plant.

IBERIA, MO.—F. S. Ramsey and brother have recently purchased the Iberia Milling Co. and will install a dynamo and supply the town with electric light.

JOPLIN, MO.—The proposition to issue $60,000 in bonds for improvements to the municipal electric-light plant and for extensions to the street-lighting system was defeated at an election held June 3.

ST. JOSEPH, MO.—The St. Joseph St. Ry., Lt., Ht. & Pwr. Co. has closed a contract with the Hammond packing plant of Armour & Co. to equip the plant for electrical operation. More than 600 hp will be required.

BELFIELD, N. D.—There has been some discussion in regard to establishing an electric-light plant at this place. The matter is now in the hands of a committee.

CANDO, N. D.—The Cando El. Co. is contemplating the purchase of a 300-line switchboard within the next 12 months. J. C. Rader is manager.

MOTT, N. D.—S. Stewart, proprietor of the Mott City Mills, is planning to install an electric-light plant. The equipment will consist of two 150-hp return-flue boilers, one 25-hp and one 75-hp Corliss engine, one 80-kw and one 50-kw, three-phase, 60-cycle, 2300-volt generator with necessary switchboard equipment and transformers, 100 meters, 50 incandescent lamps of 50 cp for street-lighting service. Mr. Stewart will carry a stock of electrical supplies, will do all house wiring and will carry household electrical appliances, etc.

NEW ROCKFORD, N. D.—A bond issue will be voted upon for the erection of a municipal electric-lighting system and water-works.

WIMBERTON, N. D.—An electric-light plant is being installed here by F. H. Etter to furnish electricity for commercial purposes and for street lighting. The plant will be driven by a kerosene oil engine. H. E. Dudrey, electrical engineer, of Moorhead, Minn., has the contract for installing the plant.

ABERDEEN, S. D.—The Aberdeen Lt. & Pwr. Co. has completed and placed in operation a complete steam-driven central power station, equipped with two 500-hp Corliss engine-driven units. The company has recently connected up three 10-hp, 2300-volt General Electric motors directly connected to centrifugal pumps for fire service.

CANTON, S. D.—The Sioux Valley Pwr. Co., of Canton, S. D., expects to erect a transmission line to Inwood, Ia., and also a hydroelectric power plant at Beloit, Ia., within the next three months. The company expects to purchase within the next four months generators and waterwheels, waterwheel governors, complete switchboards, transformers, lightning arresters, insulators and wire. Charles H. Morgan is secretary.

CENTERVILLE, S. D.—The Centerville Milling Co. expects to purchase shortly one 60-kw, 60-cycle, three-phase, 2200-volt generator and exciter.

DALLAS, S. D.—B. H. Martin, owner of the local electric-light plant, is installing a new plant, which will be in operation by July, 1913, when a 24-hour service will be established. Mr. Martin expects to purchase within the next 30 days equipment for distribution and lighting system and electrical appliances and supplies.

FRANKFORT, S. D.—It is reported that bids will soon be asked for the installation of the proposed electric-light system, for which plans and specifications have been prepared.

HOT SPRINGS, S. D.—The Cheyenne River Pwr. & Irrigation Co., recently incorporated with a capital stock of $50,000, contemplates the construction of a hydroelectric power plant near the falls of the south fork of Cheyenne River. The incorporators are: George A. Turner, John W. Parks and Henry Harty.

MITCHELL, S. D.—At a special election on June 10 bonds to the amount of $60,000 were voted for the erection of a municipal telephone plant. The City Council recently refused to renew the private telephone company's franchise.

SCHUYLER, NEB.—The Commonwealth Pwr. Co. has filed maps with the State Board of Irrigation showing its proposed Schuyler-Columbus power development. The company proposes to take water from the Loup River, 2 miles west of Columbus, and return it to the Platte River southeast of Schuyler. The reservoir and power station will be located near Schuyler. The Sharp-Moore interests, of Lincoln, Detroit and London, are said to be interested in the new enterprise.

SIDNEY, NEB.—At an election held recently the proposition to issue $22,000 in bonds for an electric-light and steam-heating plant was carried.

WILBER, NEB.—Bids will be called for the construction of the proposed municipal electric-light plant as soon as plans are completed. The proposed plant will be driven by steam power and will have an output of 125 kw. O. C. Martz, of Lincoln, is consulting engineer.

WYMORE, NEB.—The City Council has awarded contract for the purchase of an engine and two boilers, together with other equipment, for the municipal electric-light plant.

CHERRYVALE, KAN.—The Edgar Zinc Co. has decided to equip the Cherryvale smelter for electrical operation, for which it is understood that $60,000 has been appropriated. Gas engines will be used to drive generators.

HERINGTON, KAN.—The city of Herington will call another special election to vote on the proposition to issue bonds for extensions to the municipal electric-light plant and for water-works. The cost of the work is estimated at $50,000. The Benham Engineering Co., of Oklahoma City, has been engaged as consulting engineer to prepare plans and supervise the work.

SCOTT CITY, KAN.—The contract for construction of the municipal electric-light plant and water-works system has been awarded to the Alamo Engine & Supply Co., of Omaha, Neb., for $33,867.

Southern States

MAXTON, N. C.—The Maxton Lt. & Pwr. Co. is installing a small hydroelectric power plant about 1 mile from Maxton. The plant will be driven by a Morgan Smith waterwheel. The company expects to purchase wire, meters and pole trimmings. The American Machine Co., of Charlotte, has charge of the work. J. J. Kincaid is president of the Maxton company.

ABBEVILLE, S. C.—The city of Abbeville has just completed the installation of a 200-kw auxiliary steam plant with switchboard and is now installing an ornamental street-lighting system, material for which has been purchased. E. M. Anderson is superintendent.

COLUMBIA, S. C.—F. L. Moule, of Columbia, would like to receive estimates on equipment for an electric plant to maintain 600 lamps, including gasoline engine.

WASHINGTON, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 21, for construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring, interior lighting fixtures and approaches, of the United States post office at Cartersville, Ga. Plans and specifications may be obtained from the above office or from the custodian of site at Cartersville. O. Wenderoth is supervising architect.

MIAMI, FLA.—Mayor Watson has recommended the purchase of the electric-light and water plant by the city and extending the plant's lines into districts which are to be improved. J. N. MacGonigle is superintendent of the Miami El. Lt. & Pwr. Co.

NEWBERRY, FLA.—Material and machinery for the new municipal electric-light system and water-works will be purchased immediately. The new plant will occupy a brick building, and the following equipment will be installed: one 80-hp high-pressure boiler, one 60-kw generator with switchboard, exciter and street-lamp regulator, generator to be connected to 100-hp high-speed automatic engine; street-lamp equipment of 51 100-watt tungstens and five 250-watt tungstens; five 1-kw, eight 1½-kw, three 2-kw, one 3-kw and one 7½-kw transformers; poles and pole line material for 4 miles. The plant was designed and will be built by the J. B. McCrary Company, 1408 Third National Bank Building, Atlanta, Ga. J. C. Cook, chief engineer.

SARASOTA, FLA.—The Sarasota Ice & El. Co. has recently purchased one 150-kw General Electric 60-cycle, 2300-volt, three-phase generator (engine type), one 16-ft. by 18-in. four-valve Erie Ball engine and switchboard panel. R. E. Ludwig is manager.

BELLS, TENN.—The Brooks Mfg. Co., of Bells, Tenn., is considering changing the street-lighting system from multiple to the series street-lighting system. No decision will be made for some time. G. B. Brooks is manager.

ETOWAH, TENN.—The Etowah Wtr. & Lt. Co. is considering the advisability of manufacturing raw-water ice next year. W. H. Price is manager of the company.

FRANKLIN, TENN.—Within the next few months the Harpeth El. Lt. & Pwr. Co. expects to change its street-lighting system from arc to series tungsten. It is also expected that the company will secure its supply of energy from the Parksville dam at the Ocoe River. Mr. J. P. Lillie is manager of the company.

JOHNSON CITY, TENN.—The Tennessee Eastern El. Co. expects to purchase within the next 30 days one three-phase 44,000-to-2300-volt, 250-kva step-down transformer and a tub transformer and arc system for lighting Jonesboro. A. Smith is general manager at Johnson City.

MONTEREY, TENN.—The Monterey Fruit & Vegetable Association will install a 75-kw General Electric generator in its sawmill (orders for which have been placed) to furnish electricity for lighting the town. A 45-hp boiler and a 40-hp engine have already been installed. W. O. Arzinger, of Nashville, Tenn., is engineer in charge.

PARIS, TENN.—The city of Paris expects to purchase within the next three months one 300-kw, three-wire, direct-current generating unit, with switchboard. M. W. Younkin is superintendent.

ANNISTON, ALA.—The Anniston Wtr. Supply Co. is now installing a 300-hp motor to pump water into the city by electricity, giving Anniston a water supply of 4,500,000 gal. per day. Wesley Rudisill, engineer of the Anniston El. & Gas Co., is in charge of the work.

ANNISTON, ALA.—Work will soon begin, it is reported, on an extensive generating plant to be built south of the city limits by the Alabama Trac., Lt. & Pwr. Co. Power will be generated from Jackson Shoals for Anniston, Talladega and other towns in that district. On the pole line between Anniston and the shoals the voltage will be increased from 60,000 to 110,000. Later the work will be extended to Talladega.

CITRONELLE, ALA.—The Citronelle Lt., Ice & Pwr. Co., recently incorporated with a capital stock of $15,000, has purchased the plant of the Citronelle Planing Co. and will remodel same for electric-light and ice plant. A 50-kw, 60-cycle, 2300-volt generator and a 10-ton ice plant will be installed. The cost of the plant is estimated at $25,000. C. H. Lindsey is superintendent.

PONTOTOC, MISS.—The Pontotoc El. Lt. & Pwr. Co. is contemplating the construction of water-works system, including mains, pumps, additional boiler and overhead steel tank with a capacity of from 75,000 to 100,000 gal.

WALDRON, ARK.—The installation of an electric-light plant in Waldron is under consideration. S. J. Hill and W. P. Harris are interested.

NEW ORLEANS, LA.—The Southern Hydro-Electric Co. is planning the development of water-power sites on small streams in Louisiana and Mississippi. D. L. Rush, P. O. Box 285, New Orleans, is interested in the company.

ALTUS, OKLA.—The transmission line from the local municipal electric-light plant to Blair, a distance of 10 miles, will soon be completed, where electricity will be supplied for lighting the town. The city expects to erect a transmission line to Olustee, 8 miles distant, to furnish electricity for lighting that town.

TULSA, OKLA.—The Tulsa Corpn. has been taken over by the Public Ser. Co. of Oklahoma, of Oklahoma City, recently incorporated with a capital stock of $3,000,000. Fred W. Insull is president of the new company.

DENISON, TEX.—The Texas Pwr. & Light Co., Dallas, Tex., contemplates building a steam plant 4 miles north of Denison, with an ultimate capacity of 15,000 kw.

FLORESVILLE, TEX.—H. B. Harmon and O. A. Sims have purchased a lot near the depot, on which will be erected a modern building to be used for the new electric-light plant. It is expected that the plant will cost $15,000.

ROCKPORT, TEX.—The property of the Rockport El. Lt. & Ice Co. has been purchased by G. E. Fussell, of Eagle Lake. The new owner, it is understood, will remodel and enlarge the plant and establish a 24-hour service.

SEGUIN, TEX.—The Guadalupe Wtr. Pwr. Co. is completing the engineering work for the development of a hydroelectric plant on the Guadalupe River and the construction of 250 miles of transmission line. A new company is to be formed to build new electric railway lines, to be known as the Central Texas Traction Co.

TEMPLE, TEX.—The Southwestern Trac. Co. is making a survey for the proposed extensions of its interurban electric lines that are to run south from here to Austin via Granger and Taylor and north to Waco. The line of this company now runs between Belton and Temple.

WAELDER, TEX.—Steps have been taken toward the installation of an electric-light plant and ice factory in Waelder, work on which is expected to begin at an early date.

Pacific States

CHELAN, WASH.—It is expected that important developments will soon be made as a result of the Chelan Wtr. Pwr. Co. having been succeeded by the Chelan El. Co. L. W. Harper is manager.

COLVILLE, WASH.—The Stevens County Pwr. & Lt. Co. expects to erect within the next month two substations, one at Colville and one at the United Copper Mine near Chewelah, and has purchased material for 24 miles of 33,000-volt transmission lines.

LYNDEN, WASH.—Within the next few months the Puget Sound

Traction, Lt. & Pwr. Co. expects to purchase one new switchboard panel for three-phase lighting and another for series tungsten lighting and 150 poles for the reconstruction of the entire distributing system. Very shortly there will be purchased also 40 toasters and 26 irons; also a tub transformer for a new series tungsten street-lighting system to comply with a new municipal ten-year contract.

NEWPORT, WASH.—The Northern Idaho & Montana Pwr. Co., through its local manager, J. G. Flynn, reports the recent electrical storm as the worst in years. Much damage was done to lamps and primary fuses, and hundreds of incandescent lamps were burned out.

SNOHOMISH, WASH.—The Everett Gas Co., which serves Monroe and Snohomish with gas and electricity, recently renewed its contract with the Washington State Reformatory at Monroe for two years.

SOUTH BEND, WASH.—The South Bend Electric Company has been absorbed by the Twin City El. Co., with headquarters at Raymond, Wash. Clyde Bargett is local superintendent.

SPOKANE, WASH.—Eugene Enlow, S. E. Gates, W. C. Siber and associates have purchased the power plant of the Nickson-Kimmel Co., near Pateros, Wash., on the Methow River, and also the light and power plants at Okanogan. The purchasers are organizing a company which will be known as the Okanogan Valley Pwr. & Lt. Co., to be capitalized at $200,000. Eugene Enlow will be president of the new company, S. E. Gates, vice-president, and W. C. Siber secretary and treasurer.

VANCOUVER, WASH.—The Southwestern Washington Tel. Co. has applied to the County Commissioners for a right-of-way for telephone lines from Manor to Battle Ground across to Heisson, Lucia and Yacolt, a distance of about 15 miles.

WARDEN, WASH.—The Washington Wtr. Pwr. Co. will extend its power and light lines into Hartline during the summer, arrangements for which are now being made.

ARLINGTON, ORE.—It is reported that the City Auditor will receive bids for the construction of an electric-light plant and pumping station. H. F. Shank is city auditor.

BAKER, ORE.—Stannard & Richardson, of Portland, engineers, have submitted estimates of the cost of the proposed municipal electric-light plant, which indicate that the plant can be constructed at a cost not to exceed $25,000.

BIG EDDY, ORE.—John H. Lewis, state engineer, has submitted a project for developing 200,000 continuous hp at Big Eddy, a point 3 miles above The Dalles on the Columbia River. The head water is 73 ft. at low water and 42 ft. at high water and the mean flow of the river throughout the year is 235,000 cu. ft.

MYRTLE POINT, ORE.—The City Council has been petitioned for a light and power franchise for a period of 25 years by A. P. Miller, of Coquille, Ore., who offers to furnish light for city buildings and six arc lamps for each 1000 inhabitants free if the franchise is granted. The Council is considering the proposition.

PORTLAND, ORE.—The Southern Pacific Ry. Co. is said to be considering the proposition of establishing an electric-railway system from this city to San Diego, Cal., same to be completed and in operation before the Panama-Pacific Exposition. In connection with the proposed improvement the Southern Pacific has acquired water-power rights from Portland to Eugene, Ore. The extension recently built to Klamath Falls, Ore., will be electrified at once.

ROSEBURG, ORE.—The Douglas County Lt. & Pwr. Co. is installing an electric-light plant in Winchester. The equipment will consist of a 68-in. Allis-Chalmers waterwheel directly connected to a 500-kw vertical generator manufactured by the Allis-Chalmers Co. J. R. Thompson, of Portland, is engineer in charge.

BAKERSFIELD, CAL.—The San Joaquin Lt. & Pwr. Corpn. has announced that it will reconstruct the Kern River power plant throughout immediately. The tunnel will be enlarged, new waterwheels installed and a new power house building erected. A. G. Wishon is general manager.

COLFAX, CAL.—Application has been made to the State Railroad Commission by D. C. Gillen, owner of the local electric-light plant, for permission to sell his property to the Pacific Gas & El. Co. for $12,000.

FRESNO, CAL.—The San Joaquin Lt. & Pwr. Co. is planning the construction of a large number of additions to its present distribution systems at Santa Maria, San Luis Obispo and San Miguel. Some additions will also be made to the systems at Maricopa and Bakersfield. About $2,000,000 will be expended. A. C. Balch is president of the corporation and A. G. Wishon is general manager.

LOS ANGELES, CAL.—The Midland Counties Public Ser. Co., of Los Angeles, recently organized, with a capital stock of $2,500,000, plans to take over the Coalinga Wtr. & El. Co., of Coalinga; the Midland Counties Gas & El. Co., of San Luis Obispo; the Russell-Robinson Wtr. & El. Co., of Arroyo Grande, and the Paso Robles Land & Wtr. Co., of Paso Robles. The new company also has an authorized bond issue of $3,000,000 awaiting the approval of the State Railroad Commission.

NEWPORT BEACH, CAL.—The Board of Trustees has authorized the sale of a 30-year electric franchise at the request of the Pacific Lt. & Pwr. Co. The franchise will be sold July 7 to the highest bidder. The city voted last September to issue $25,000 in bonds to install a municipal electric-light plant, but has not yet sold them.

OROVILLE, CAL.—The Board of Supervisors of Butte County has granted a franchise to the Great Western Pwr. Co. to build and operate electric distribution systems in Butte County. The company will begin a high-tension transmission line into the county immediately from Plumas. Mortimer Fleishhacker is president of the company.

PORTERVILLE, CAL.—Plans have been practically completed by the officials of the Mount Whitney Pwr. Co. for a large addition to the equipment of their substation at Fourth Street and Putnam Avenue.

SAN FRANCISCO, CAL.—The Pacific Gas & El. Co., of San Francisco, has applied to the State Railroad Commission for permission to purchase certain water rights, flumes and ditches in the vicinity of Gold Run from the United Water & Pwr. Co.

SAN FRANCISCO, CAL.—The San Diego Consolidated Gas & El. Co. has asked the State Railroad Commission for permission to issue $639,000 in bonds. Of the proceeds, $459,000 will be used in making extensions to the company's plant and the balance of $180,000 will be used to pay existing indebtedness.

VENICE, CAL.—The City Trustees of Venice have requested bids on 312 five-lamp ornamental street-lighting posts to be installed in the canal district of the city. The bids should include the installation of the posts complete and ready for service.

BONNER'S FERRY, IDAHO.—The Moyea Wtr. Pwr. Co. has filed a claim on a power site at Moyea Falls, on which a 10,000-hp hydroelectric plant will be built. There will be utilized 5000 hp or 6000 hp to light Bonner's Ferry and surrounding country. A. H. Featherstone, Wallace, Idaho, is promoter of the project.

DOWNEY, IDAHO.—The City Council has granted the Utah Lt. & Pwr. Co. a franchise in Downey. The company will install a plant here at once.

MONTPELIER, IDAHO—Negotiations have been completed by the Utah Pwr. & Lt. Co. for the purchase of the property of the Bear Lake Pwr. Co., of Montpelier, consisting of two plants, one at Georgetown and the other at Paris. The Bear Lake company furnishes electricity in the towns of Montpelier, Bloomington, Georgetown, Bennington, St. Charles and Ovid, Idaho.

PARK CITY, UTAH.—Louis A. Jeffs has petitioned for a franchise for an electric-light plant.

FLAGSTAFF, ARIZ.—The new plant of the Flagstaff El. Co. will have a capacity of 300 kw and give 24-hour service. The contract for the machinery has been closed with C. C. Moore & Co. G. T. Herrington is manager.

CUT BANK, MONT.—The Two Miracle Concrete Co., Great Falls, Mont., has been awarded the contract by the city of Cut Bank for supplying material and equipment and installing a water-works and lighting plant, at a cost of $41,000.

FORT BAYARD, N. M.—Bids will be received by Lieut. C. E. Holmberg, quartermaster, Fort Bayard, until July 9 for sale of two Kewanee 100-hp return-tubular boilers, two 50-kw General Electric direct-current generators and engines, switchboard complete for two generators, one 7½-ton York ice machine, one 2-ton ice machine, 99 50-lb. ice cans and two steam pumps. Further information can be obtained on application.

LAS VEGAS, N. M.—Active work will begin this summer on the construction of a hydroelectric power plant near Indian Springs. The initial installation will provide for the development of 1500 hp, which will be transmitted to Las Vegas at 6000 volts. The water will be piped from the Charleston Mountain Range, a distance of 12 miles, with a fall of about 3000 ft. Five power stations, each with an output of 1500 hp, will be built. Midway on the line a dam forming a large storage reservoir will be built to impound the storm waters. A transmission line will also be erected through a pass in the mountains into the Pahrump Valley to supply electricity for operating pumping plants, and also extending to Goodsprings, where it will furnish energy to mines and mills. Water will also be furnished to irrigate about 16,000 acres taken under the Carey act by the Southland Irrigation Co. Ira McFarland, of Las Vegas, is interested.

Canada

SUMMERLAND, B. C.—The installation of a 60-kw generator driven by a Diesel oil engine in the municipal electric-light plant is contemplated this year or next.

MARKHAM, ONT.—The Council has adopted a resolution to ask the Hydro-Electric Power Commission of Ontario to extend its line to furnish electricity here.

NEWMARKET, ONT.—The ratepayers have rejected the proposition of the Toronto & York Radial Ry. Co. to furnish the town with power at $25.50 per hp per year, with the provision that the town install the necessary distributing system at a cost of $12,000. This undoubtedly means that the Hydro-Electric Power Commission of Ontario will be petitioned to extend its lines into the town to furnish electricity here. The commission offers to furnish the service at $27.90 per hp per year.

OTTAWA, ONT.—Tenders will be received by G. J. Desbarats, deputy minister, Department of Naval Service, Ottawa, Ont., until June 25 for the erection of masts and buildings for wireless-telegraph stations to be erected at Kingston, Toronto and Port Burwell. Plans and specifications and form of contract can be seen at the office of the general superintendent of the wireless service, Department of Naval Service, Ottawa, or at the offices of the postmaster, Kingston, harbormaster, Toronto, and postmaster, Port Burwell.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario has decided to start work at once on the St. Thomas-Windsor transmission line, contract for which has been awarded for some time. The commission has not yet decided upon the route between St. Thomas and Chatham.

POINT ROGUE, QUE.—Charles A. Julien, owner of the local electric-light plant, expects to purchase within the next six months 12 transformers and motors and electrical cooking apparatus, etc.

RICHMOND, QUE.—The Canada Paper Co., of Montreal, has purchased the power rights of John R. Hall on the St. Francis River and the rights at Kingsey Falls, also on the St. Francis River. It is estimated that two falls will develop about 1500 hp. It is understood that the water-power will be developed and energy transmitted to Windsor Mills to be used in the factories there of the Canada Paper Co. and the Canadian Explosives, Ltd.

New Industrial Companies

THE ENGUTIL MANUFACTURING COMPANY, INC., of New York, N. Y., has been incorporated with a capital stock of $125,000 by C. W. Crawford, W. J. Mackay and G. M. Miller, all of 1 Madison Avenue, New York. The company proposes to manufacture and deal in engines, boilers, motors, tools, etc.

THE A. ESTELMANN COMPANY, INC., of New York, N. Y., has been incorporated by Harry A. Bell, August Estelmann and Peter A. Warucke, 142 West 109th Street, New York, N. Y. The company is capitalized at $15,000 and proposes to manufacture motors, engines and machines.

GAGEN & BUTLER, INC., of New York, N. Y., has been incorporated with a capital stock of $15,000 to do a general contracting and electrical business. The incorporators are: James E. Finegan, Edwin C. Butler and James M. Gagen, 520 West Fifty-fourth Street, New York, N. Y.

THE GREATER NEW YORK ELECTRIC PROTECTIVE COMPANY, INC., of New York, N. Y., has been chartered with a capital stock of $1,000. The incorporators are: Philip C. Stone, of New York; Max Kivowitz and R. Goldstein, of Brooklyn, N. Y.

THE GULF ELECTRIC COMPANY, of New Orleans, La., has been incorporated to do an electro-mechanic engineering business, constructing power plants and transmission systems. W. E. Carpenter, of Detroit, Mich., is president, A. W. Lewin vice-president, C. W. Koch secretary, and G. L. Champagne treasurer. The office of the company is at 626 Carondelet Street, New Orleans.

THE HOT POINT ELECTRIC HEATING COMPANY, of Ontario, Cal., has been incorporated with a capital stock of $273,000 to manufacture and deal in electric lighting, heating and power materials. The officers are: Franklin Booth, 519 Occidental Boulevard, Los Angeles, president; E. H. Richardson, F and Lemon Streets, Ontario, secretary and treasurer. The principal office is located in Chicago, Ill.

New Incorporations

PHOENIX, ARIZ.—The Hassayampa Canal, Irrigation & Pwr. Co. has been incorporated with a capital stock of $120,000 by J. R. Deal, R. A. Roberts, Sr., Perry H. Deal and R. A. Roberts

HARTFORD, CONN.—The Griffing-Scofield El. Co. has been incorporated with a capital stock of $20,000 to deal in electrical apparatus and appliances.

NORFOLK, CONN.—The Wangum Realty Co. has been incorporated with a capital stock of $50,000.

WILMINGTON, DEL.—The Tropical Radio-Telegraph Co. has been incorporated with a capital stock of $10,000. Oscar J. Reichard, of Wilmington, is the chief incorporator.

WILMINGTON, DEL.—The Imperial Hydro-Electric Corporation has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,500,000. The incorporators are: H. E. Latter, W. J. Maloney and O. J. Reichard.

CHARLOTTE, IA.—The Charlotte El. Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000. C. W. Beeby is president of the company.

FAIRFIELD, IA.—The Iowa Utilities Co. has been chartered with a capital stock of $225,000 to generate electricity and gas for light, heat and power. The incorporators are: Hubert Howard, of Chicago, Ill.; Herbert Haase, of Western Springs, Ill., and others.

EMMITTSBURG, MD.—The Emmittsburg El. Co. has been incorporated with a capital stock of $7,500 to construct an electric-light plant. The incorporators are: Thomas Gelwicks, Albert M. Patterson, John D. Brawner and others.

MINNEAPOLIS, MINN.—Articles of incorporation have been filed for the Findley El. Co., with a capital stock of $50,000. Its incorporators are: Thomas W. Findley, Samuel H. Findley, Jr., and A. K. Findley, of Minneapolis.

ST. THOMAS, ONT.—The Western Ontario El. Co. has been incorporated with a capital stock of $25,000 by C. A. Branston, C. F. Goodwin and G. J. Warney.

Trade Publications

ARC PANELS AND GENERATORS.—The General Electric Company has published Bulletin No. A-4122, devoted to carrier bus arc panels and brush arc generators.

ALTERNATORS.—Bulletin No. A-4109 of the General Electric Company refers to belt-driven revolving-armature alternators, illustrating and describing this apparatus.

ELECTRIC IRONS.—In a broadside recently issued by the Hotpoint Electric Heating Company, Ontario, Cal., a special bid is made for the sale of goose irons and V irons to tailors, cleaners and pressers.

SWITCHES.—The use of horn-type apparatus is illustrated by five halftones in a leaflet recently issued by the Railway & Industrial Engineering Company. Its varied uses for nine different purposes in controlling high-tension circuits are briefly referred to.

COPPER-CLAD WIRE.—One of the late leaflets of the series being sent out by the Duplex Metals Company, Chester, Pa., with the title "New Clothes for Old," suggests that copper-clad tie wires can be purchased in convenient bundles, cut to length, and that they are better than copper because they are stronger.

GRAPHITE BRUSHES.—A sixteen-page booklet referring to its graphite brushes is being distributed by the Joseph Dixon Crucible Company, Jersey City, N. J. The brushes, which are composed almost entirely of high-grade graphite, are said to prevent sparking and wear of the commutator. Graphite resistance rods are also mentioned.

OIL SWITCHES.—The General Electric Company has issued Bulletin No. A-4114, containing preliminary information on central-station oil switches known as Type F, Form K-21, which are used on systems operating at voltages up to 110,000. The construction of the switches is shown in detail, the various operating mechanisms being illustrated and described.

AIR COMPRESSORS.—The Clayton Compressor Works (International Steam Pump Company, successors), 115 Broadway, New York, have issued a catalog in Spanish referring to their air compressors. A comprehensive illustrated description of this apparatus is given and the operating characteristics are shown. The publication, which is well printed, is known as Boletin C-210-S.

ELECTRIC TRUCKS.—The General Electric Vehicle Company, Inc., Long Island City, N. Y., is sending out two leaflets referring to the use of electric trucks as compared with horse-drawn vehicles. One is a reprint from the *Mirror* of Altoona, Pa., entitled "Horses Are Doomed for Light Work." The other, with the title "The Horse Must Go!" is a reprint from the *Commercial Vehicle*.

SURFACE CONDENSERS.—Bulletin 106-A of the Wheeler Condenser & Engineering Company, of Carteret, N. J., takes up such subjects as the effect of condensing on steam-engine and steam-turbine economy, the influence of steam distribution and the effects of flooding on condenser surface, and explains the advantages of the dry-tube condenser. Consideration is also given to the subject of air pumps for surface condensers.

POLE-MEASURING DEVICE.—W. N. Matthews & Brother, 3740 Forest Park Boulevard, St. Louis, Mo., have issued a single-page leaflet which illustrates and refers briefly to the Matthews teleheight—an instrument that gives at once the length of pole necessary to clear a certain object. Another leaflet issued by this company tells about the Matthews telefault, a device that will find "grounds," crosses, split pairs and "dead shorts" and wet spots.

Business Notes

DE LAVAL STEAM TURBINE COMPANY.—Mr. H. L. Watson, formerly sales engineer for the Allis-Chalmers Manufacturing Company, of Milwaukee, has accepted the position of sales manager for the De Laval Steam Turbine Company, of Trenton, N. J., manufacturer of steam turbines of the single-stage, velocity-stage and pressure-stage types, also of centrifugal pumps, speed-reduction gears, turbine blowers and other apparatus of an allied nature.

TRIUMPH ELECTRIC COMPANY.—Mr. J. C. Hobart has been elected president of the Triumph Electric Company, of Cincinnati, Ohio, to succeed his father, Mr. William N. Hobart, whose death occurred some time ago. Mr. Hobart has been secretary and general manager of the company since its organization in 1889. The other officers are as follows: First vice-president, Mr. Edward Rawson; second vice-president, Mr. W. H. Jacob; third vice-president, Mr. J. S. Louis; secretary, Mr. Graham P. Hunt. The officers and Mr. W. E. Hutton constitute the board of directors.

THE ROBBINS & MYERS COMPANY, manufacturer of motors, generators and electric fans, with home offices and factory at Springfield, Ohio, has opened two new branch sales offices, one in the First National Bank Building, Cincinnati, Ohio, in charge of Mr. G. H. Liebel. Mr. Liebel will look after sales of Robbins & Myers motors and generators in Cincinnati, Louisville and contiguous territory. The other branch is at No. 369 Spitzer Building, Toledo, Ohio, where Mr. E. A. Williams will make his headquarters and will have charge of sales in the territory of northwestern Ohio, southern Michigan, including Detroit, and northeastern Indiana.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 10, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York]

1,063,950. ELECTRIC-CURRENT-CONTROLLING DEVICE; A. E. Berdon, Lafayette, Ill. App. filed July 5, 1910. For charging storage batteries of car-lighting systems.

1,063,999. APPARATUS FOR ELECTRIC WELDING; C. R. Murray, L. R. Brink and W. K. Malmstrom, Chicago, Ill. App. filed April 15, 1912. For welding pieces of different cross-section; opposed clamping jaws with an electrode lying in a plane central between the jaw faces.

1,064,025. MOTOR CONTROLLER; F. L. Stone, Schenectady, N. Y. App. filed Dec. 30, 1911. To prevent too rapid acceleration or retardation; controller can only be moved as fast as rotation of motor will permit.

1,064,026. ELECTRICAL GENERATOR; T. K. Strand, Rolette, N. D. App. filed April 3, 1911. Generator is mounted upon the rotatable head of a windmill.

1,064,033. JUNCTION BOX; J. F. Wagner, South Bend, Ind. App. filed Aug. 23, 1911. Knock-out portions formed by circular grooves in the wall of the box.

1,064,049. APPARATUS FOR RECORDING CALLS MADE BY TELEPHONE; E. H. Bridge, Spotswood, Victoria, Australia. App. filed Oct. 25, 1911. Effective calls are registered by meter only when both receivers are taken up for a conversation.

1,064,064. METHOD AND APPARATUS FOR PRODUCING A GASEOUS REACTION BY A SILENT DISCHARGE; M. W. Franklin, Schenectady, N. Y. App. filed Oct. 21, 1911. Ozonized air is produced by passing a current of fresh air through the ozone unit and mixing the fresh air with the ozonized air during successive stages of the ozonization.

1,064,065. OZONATOR; M. W. Franklin, Schenectady, N. Y. App. filed Oct. 31, 1912. Produces gaseous reaction by static discharge; difference of potential between electrodes produced by transformer.

1,064,078. ELECTRIC WELDING MACHINE; L. E. McKinnon and A. W. Southall, Buffalo, N. Y. App. filed June 17, 1908. For welding chains; carriages movable toward each other and carrying yielding and adjustably mounted electrodes.

1,064,079. ELECTRIC WELDING MACHINE; L. E. McKinnon, Buffalo, N. Y. App. filed June 17, 1908. Intermittent welding current produced by interrupting the circuit periodically and at greater or less frequency.

1,064,089. MOTOR VEHICLE; W. P. Rayner, Philadelphia, Pa. App. filed June 23, 1910. Vehicle is started and driven at low speed by electric motor and at high speed by gas engine.

1,064,096. ELECTRICAL SWITCH; W. M. Scott, Philadelphia, Pa. App. filed March 12, 1906. Operating handle is disengageable from switch mechanism to prevent operator from restoring it during a predetermined electrical condition.

1,064,115. VAPOR-ELECTRIC DEVICE; W. Weintraub, Lynn, Mass. App. filed Dec. 13, 1910. Mercury-vapor lamp with inner and outer envelopes and a conical closure operated by the vapor pressure to seal the inner envelope.

1,064,116. VAPOR-ELECTRIC DEVICE; E. Weintraub, Lynn, Mass. App. filed Aug. 12, 1911. Capillary passage between inner and outer envelopes of mercury-vapor lamps and a valve for equalizing the mercury level within and without the inner envelopes.

1,064,131. POWER-FACTOR INDICATOR; J. A. Craighead, Schenectady, N. Y. App. filed Oct. 7, 1911. For alternating-current circuits not affected by ordinary changes in frequency occuring in commercial circuits.

1,064,137. ELECTRIC CLOCK; J. F. Engle, Cleveland, Ohio. App. filed May 13, 1912. Self-winding, direct-acting contacts made and broken mechanically.

1,064,138. LOW-WATER ALARM; C. W. Ford, Pittsburgh, Pa. App. filed June 19, 1912. Differential expansion of certain parts causes other elements to contact and complete circuit.

1,064,142. SAFETY DEVICE FOR RAILROAD TRAINS; W. F. Greene, Huntingdon, Pa. App. filed Aug. 16, 1912. Breaking of arch bars of the trucks ruptures circuit and gives alarm.

1,064,190. ELECTRIC AIR HEATER; L. A. Bill, Cambridge, Mass. App. filed Dec. 14, 1912. For carburetors; conical wire-heating coil freely supported inside the air intake pipe.

1,064,205. MOTOR-ACCELERATING DEVICE; E. L. Gale, Sr., Yonkers, N. Y. App. filed Nov. 9, 1909. Combination of mechanical and electrical means for effecting acceleration of alternating-current motors in elevator work.

1,064,211. GALVANIC CELL; A. Heil, Frankfort-on-the-Main, Germany. App. filed May 2, 1912. Produces depolarizing electrodes by saturating porous carbon with a solution of manganese nitrate and then drying and heating the carbon to decompose the nitrate.

1,064,224. MOTOR-CONTROLLING MECHANISM; J. D. Ihlder, New York, N. Y. App. filed Oct. 31, 1908. For automatically controlling an electric motor to stop an elevator car at predetermined points regardless of speed, load or friction.

1,064,228. AUTOMATIC STARTING SWITCH; C. D. Knight, Schenectady, N. Y. App. filed Dec. 1, 1905. Automatically provides the proper time intervals between charges in circuit connections.

1,064,258. ELECTRIC HEATER; G. E. Sharpe, Steubenville, Ohio. App. filed Oct. 30, 1912. Portable heater employing lamps as heating agent; heating effected by circulation as well as radiation.

1,064,295. SUPPORT FOR END TURNS OR CONNECTIONS OF COILS FOR DYNAMO-ELECTRIC MACHINES; W. F. Dawson, Rugby, England. App. filed Jan. 30, 1907. Clamping devices hold the end turns.

1,064,310. DYNAMO-ELECTRIC MACHINE; W. J. Foster, Schenectady, N. Y. App. filed Oct. 13, 1905. Rotating member of the smooth-core type specially balanced for high-speed work in connection with turbines.

1,064,318. ELECTRICAL SWITCH; H. R. Gilson, Beaver, Pa. App. filed April 1, 1912. Push-button type; spring contact having an incline engaged by a movable dog.

1,064,330. ELECTRICAL HEATER; A. C. Hulbert, San Francisco, Cal. App. filed April 22, 1912. Heater unit has a handle which lies in the handle of the utensil, and heater can be removed to permit use of utensil for ordinary purposes.

1,064,338. ELECTRIC-WELDING PROCESS; E. Katzinger, Chicago, Ill. App. filed May 9, 1910. For spot-welding sheets of different thickness together; stamps protuberances on one sheet, which are pressed against the other sheet and welding current sent therethrough.

1,064,358. ELECTRIC STOVE; C. Mettler, New Haven, Conn. App. filed Feb. 11, 1913. Weight of the cooking utensil on the stove closes the heating circuit.

1,064,370. MULTIPLE-SERVICE BATTERY CABINET; G. L. Patterson, New York, N. Y. App. filed Aug. 21, 1912. Plurality of series of multiple-battery units, the units of each series being suitably connected and the series of units each being provided with means for interconnection and with service terminals.

1,064,373. TELEGRAPH TRANSMITTER; E. C. Phillips and T. Rhodus, Chicago, Ill. App. filed Feb. 17, 1912. Typewriter transmitter.

1,064,402. PIPE-CONDUIT FITTING FOR ELECTRIC INSTALLATION; W. H. Vibber, New London, Conn. App filed Oct. 3, 1910. For unthreaded conduits; fitting, "junction" or "terminal" made in two half-sections clamped together.

1,064,422. PULL SWITCH FOR WALL BOXES; F. Barr, New York, N. Y. App. filed Jan. 17, 1911. Inclosure, chain guide and insulation and switch mechanism.

1,064,423. SOCKET FOR LAMPS, ETC.; F. Barr, New York, N. Y. App. filed March 23, 1912. Cap lining; clip attachment.

1,064,424. SOCKET CONSTRUCTION; F. Barr, New York, N. Y. App. filed Aug. 2, 1912. Cap lining and ring lock.

1,064,433. METHOD OF REDUCING TELEPHONIC DISTURBANCES; O. B. Blackwell and G. A. Anderegg, Maplewood, N. J., and Oak Park, Ill. App. filed April 11, 1912. Combines the capacities of the groups of conductors so that they tend to balance.

1,064,434. ALTERNATING-CURRENT RECTIFIER; D. M. Bliss, West Orange, N. J. App. filed Aug. 21, 1911. Single rotating commutator and brushes.

1,064,471. THERMOTELEPHONE OR THE LIKE; B. Gwozdz, Berlin, Germany. App. filed Nov. 15, 1912. Wollaston wire passing through a plastic hardening body with a bent portion projecting out of the same and a hard body surrounding and protecting the plastic hardening body.

1,064,492. MUFFLER ATTACHMENT FOR TELEPHONES; G. Kracker, Philadelphia, Pa. App. filed Jan. 18, 1912. Sound-muffling spiral surrounds the telephone mouthpiece, so as to muffle sound to the exterior without interfering with the proper transmission of the sound.

1,064,512. ELECTROMAGNET; F. W. Martini, Chicago, Ill. App. filed Oct. 26, 1912. Magnet has a solid core and an extendable plicatile armature.

1,064,541. SYSTEM OF DISTRIBUTING ELECTRIC ENERGY; I. J. Reuter and F. P. McDermott, Jr., Anderson, Ind. App. filed April 4, 1912. Switch reverses direction of current through current-consuming means each time that the current is started by the switch.

1,064,571. BASE FOR ELECTRIC INCANDESCENT LAMPS; P. G. Triquet, Paris, France. App. filed July 28, 1910. The terminal collar of the lamp is insulated from the metallic base of the lamp.

1,064,599. TELEPHONE ATTACHMENT; W. Bimson, Philadelphia, Pa. App. filed Feb. 2, 1912. Receiver is supported in a holder which is actuated to cut in the receiver by a movement of the head.

1,064,658. INCUBATOR ALARM; C. W. Kelley, Wellington, Tex. App. filed June 26, 1912. Thermostat closes circuit when temperature rises above or falls below predetermined points.

1,064,669. ALTERNATING-CURRENT GENERATOR; A. Scherbius, J. Jonas and H. Meyer-Delius, Baden, Switzerland. App. filed Feb. 28, 1912. Alternating-current collector machines having a series characteristic are worked as generators.

1,064,673. DANGER SIGNAL FOR RAILWAYS; C. N. Steevens, Owego, N. Y. App. filed Nov. 7, 1911. For grade crossings; shutters automatically thrown into indicating position.

1,064,682. ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS; A. T. Dawson and G. T. Buckhan, Westminster, London, Eng. App. filed Nov. 26, 1906. For communicating range, deflection, etc., from the conning tower of a ship.

1,064,685. ELECTRIC-LIGHTING APPARATUS; P. C. Hewitt, New York, N. Y. App. filed March 23, 1901. Vapor lamp; contacting electrodes are separated when the lamp is in operation.

1,064,686. GAS OR VAPOR ELECTRIC APPARATUS; P. C. Hewitt, New York, N. Y. App. filed March 23, 1901. A solid electrical connection between the two electrodes is provided, which is severed by electromagnets, one of which acts more slowly than the other.

1,064,688. ELECTRIC LIGHTING APPARATUS; P. C. Hewitt, Ringwood Manor, N. J. App. filed March 23, 1901. Pivoted anode which is lifted from the mercury cathode to break the contact.

1,064,689. VAPOR-ELECTRIC DEVICE; P. C. Hewitt, Ringwood Manor, N. J. App. filed Dec. 6, 1910. Electromagnet for rocking the lamp from its normal horizontal position.

1,064,690. AUTOMATIC STARTING DEVICE FOR VAPOR LAMPS; P. C. Hewitt, New York, N. Y. App. filed May 2, 1903. Electromagnet arranged to lift a conductor which bridges between the positive and negative electrodes.

1,064,691. SYSTEM OF ELECTRICAL DISTRIBUTION; P. C. Hewitt, New York, N. Y. App. filed April 28, 1905. Electromagnet lifts a hinged supplementary starting anode out of contact with mercury cathode and a transformer with one coil in circuit with the starting anode.

13,572 (reissue). SELECTIVE SYSTEM; E. R. Carichoff, Schenectady, N. Y. App. filed May 3, 1913 (original No. 1,057,035, dated March 25, 1913). Means for automatically connecting control and lighting circuits of the car to the trolley or to the dynamotor according to whether the car is on a high-potential or a low-potential section of the line.